US Army Corps of Engineers®
Savannah District

Glades Reservoir Draft Environmental Impact Statement

Chapter 4

Environmental Consequences

October 2015

4 ENVIRONMENTAL CONSEQUENCES

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4 ENVIRONMENTAL CONSEQUENCES

4.5 Impacts to Soils and Geology

The evaluation of potential impacts to soils and geology considered whether the proposed action or an alternative would cause any of the following conditions:

- Soil erosion or loss of topsoil
- Permanent impacts from construction of facilities such as reservoir, pump station, pipelines, and access roads
- Impacts to mining and mineral needs
- Direct conversion of prime and unique farmland to non-agricultural uses

Impacts to soils and geology were assessed based on Natural Resources Conservation Service (NRCS) soil survey data, including the 2010 NRCS Soil Survey of Barrow, Hall, and Jackson Counties, Georgia and the 2010 NRCS Soil Survey for Dawson, Lumpkin, and White Counties, Georgia.

4.5.1 Soil Erosion, Topsoil Loss, and Permanent Construction Impacts

The construction of the dam and reservoir for the Proposed Project and alternatives would result in the loss of geologic resources (sand, gravel, clay, and bedrock). Construction activities for the proposed water supply infrastructure would accelerate erosion, increasing the loss of soil. Excavating and filling the area for the dam footprint, as well as filling the reservoir, also would result in soil loss. The area below the reservoir's normal pool water surface area would be flooded on a regular basis and the area between normal pool and flood pool would be reserved for flood storage; these areas would not be available for agricultural, mining, or other uses. The total disturbed area - the maximum area where potential impacts to soils and geology may occur, including permanent impacts from construction of water supply infrastructure components such as reservoirs, pump stations, pipelines, and access roads to these facilities was calculated for each alternative. The magnitude of potential effects from increased erosion or sedimentation, and the loss of farmland acreage are defined by the disturbance area. The total disturbance area of each alternative is summarized in Section 4.5.4.

4.5.2 Mining and Mineral Needs

One former gold mine, Glade Mine, lies within the footprint of the proposed Glades Reservoir. The Glade Mine is no longer an active mine. No former mine sites were identified to be associated with the White Creek Reservoir site or on any proposed transmission routes. Therefore, no environmental consequences are anticipated to mining or mineral needs from the construction of the Proposed Project or alternatives.

4.5.3 Prime and Unique Farmland

Georgia recognizes two categories of important farmlands based on their soil types: prime farmland and additional farmland of statewide importance. The reservoir construction would result in the conversion of potentially prime farmland or farmland of statewide importance to flooded areas (non-agricultural use). Construction of pipelines and pump stations, while not directly impacting the underlying soils, will restrict the future use of potential prime farmland. The area that is anticipated to be disturbed is estimated based on publicly available county soils survey and will be updated as appropriate with details resulting from the coordination with NRCS.

4.5.3.1 Food and Fiber Production

The area directly influenced by the Proposed Project and alternatives for food and finer production includes the areas inundated by reservoir and the proposed right of way for roads, pipelines, pump stations etc. The impacts to food and fiber production are evaluated based on the loss of farmland and agriculture. For Alternatives 1-9 (Glades alternatives) the impacts would be similar; Alternatives 10 and 11 (White Creek alternatives) would impact lower acreage of farmland as White Creek Reservoir has a smaller footprint. The No Action Alternatives has the least impacts in terms of loss of farmland. The Applicant can offer minor fishing activities in the reservoir which is considered a food source and slightly beneficial for all Alternatives 1 through 11.

4.5.4 Summary of Impacts by Alternatives

Table 4.38 summarizes the estimated total disturbed area and the potential prime farmland or farmland for statewide importance disturbed by the construction of water supply infrastructure for each alternative. Alternatives 9 and 10 have lower disturbed areas because the White Creek Reservoir site has a smaller footprint and as a result, lower total disturbed area and farmland impacts.

Table 4.38 Soils and Farmland Impact Summary

Alternative #	Alternative ID	Total Disturbed Area (Acres)[1]	Prime Farmland Disturbed (Acres)[1,2]	Farmland of Statewide Importance Disturbed (Acres)
Applicant	L18-G50-PT	1019	11	211
1	L18-G42-PT	1019	11	211
2	L18-G42-PL	1115	12	221
3	L18-G42-WTP	1061	11	211
4	L30-G30-PT	1019	11	211
5	L30-G30-PL	1115	12	221
6	L30-G30-WTP	1051	11	211
7	L43-G17-PT	1019	11	211
8	L43-G17-PL	1115	12	221
9	L43-G17-WTP	1041	11	211
10	L43-W17-PT	669	15	178
11	L43-W17-PL	790	16	193
No Action	L60	0	0	0

[1] Based on flood pool water surface area and a pipeline trench width of 30 feet
[2] Based on publicly available county soils data

Moderate direct impacts at the Glades Reservoir or White Creek Reservoir sites include the loss of mineral resources such as sand, gravel, and bedrock that would be used as borrow material for dam construction. Borrow material for the dam would be extracted entirely from the reservoir pool area. Topography of the borrow areas would be permanently changed by removal of material; once the reservoir is filled, the reservoir pool would cover these areas.

4.5.4.1 Mitigation and Monitoring

The following recommendations are made with respect to mitigation and monitoring of soil and geologic impacts:

- Various erosion mitigation measures should be implemented during construction and operation of the facilities, such as silt fences, silt traps, sedimentation pond/basin, design of slopes with rolled erosion control products, vegetation, riprap, or a combination of these. Visual monitoring of the facilities may be conducted to evaluate the impact of erosion and the effectiveness of erosion protection measures.
- Impacts due to human activities or traffic during construction should be reduced and controlled by restricting access points and proper planning of construction vehicle traffic and parking areas.
- In the dam and reservoir construction areas, cut slopes should be designed to provide adequate slope stability for the temporary construction and long-term loading conditions at each site.

- Reservoir rim instability may be mitigated with design of slope stabilization measures, such as flattening slopes, installing drains, and constructing slope stabilization features. Monitoring of unstable slopes may include mapping, installation of survey monuments, periodic air photo review, and installation of slope movement instruments such as inclinometers and survey monuments.
- Erosion and stability of excavations associated with all pipelines should be mitigated with design of erosion control and excavation stability measures. This is especially necessary where pipelines cross drainage ways.

4.6 Land Use

Land use of the potential affected areas was obtained from the Georgia Land Use Trends (GLUT) 2008 land use data. The following discussion describes the pre-construction and post-construction land use for the Proposed Project and each alternative. Each of the alternatives is comprised of a combination of infrastructure components: either Glades Reservoir or White Creek Reservoir as a water supply component, along with pump stations, transmission mains with a 30-foot permanent easement, and/or the construction of a new WTP. For the majority of the alternatives, deciduous forest, evergreen forests, mixed forest, and row crop/pasture make up the bulk of the baseline land use. The land use after the construction of the water supply system transitions to high intensity urban (pump station and WTP), open water (reservoirs), and to utility swaths (transmission mains). The land use analysis is based on the total disturbed area shown in **Table 4.39**. Changes in land use are described in the following sub-sections for the Proposed Project and alternatives.

Table 4.39 Land Disturbance Summary Table

Alternative #	Alternative ID	Disturbed Acreage
Applicant	L18-G50-PT	1018
1	L18-G42-PT	1018
2	L18-G42-PL	1112
3	L18-G42-WTP	1061
4	L30-G30-PT	1018
5	L30-G30-PL	1112
6	L30-G30-WTP	1051
7	L43-G17-PT	1018
8	L43-G17-PL	1112
9	L43-G17-WTP	1041
10	L43-W17-PT	667
11	L43-W17-PL	785
No Action	L60	---

4.6.1 Applicant's Proposed Project (L18-G50-PT)

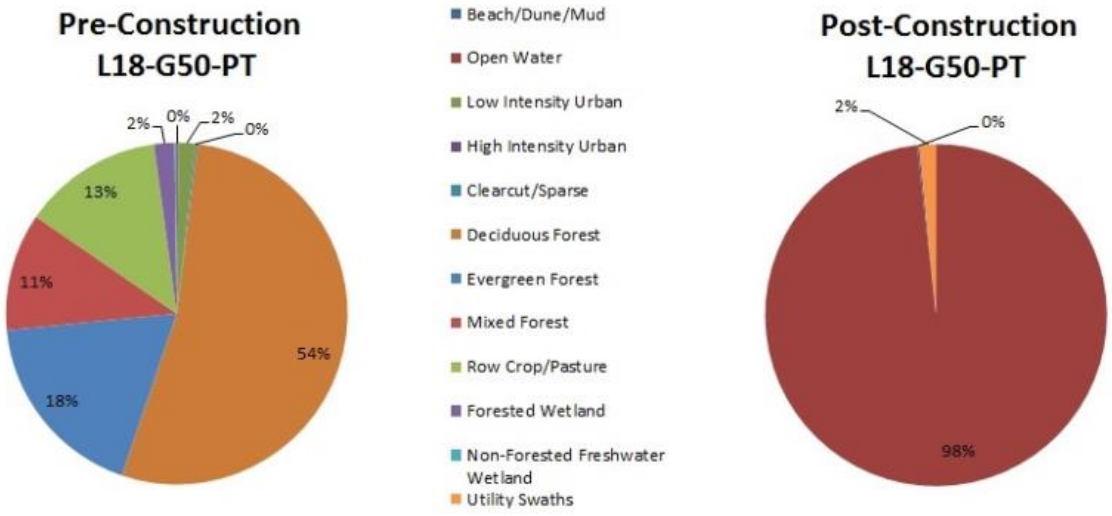
The establishment of this alternative would require the construction of the Glades Reservoir and a raw water transmission system from the Chattahoochee River to the reservoir. The baseline land use of the Applicant's Proposed Project primarily consists of approximately 53% deciduous forest and a mixture of evergreen forest, mixed forest, and row crop/pasture land. **Table 4.40** is an acreage breakdown of the land use changes; **Figure 4.61** shows the respective percentage change in land use.

Construction of the Applicant's Proposed Project would have an impact on a total of 1018 acres of land. The land would be converted to 98% open water (1002 acres), 2% utility swaths (approximately 14 acres), and 2 acres of high intensity urban.

Table 4.40 Applicant's Proposed Project (L18-G50-PT) Land Use Changes

	Proposed Project	
Land Use	Pre-Construction (Acres)	Post-Construction (Acres)
Beach/Dune/Mud	0	0
Open Water	2	1002
Low Intensity Urban	15	0
High Intensity Urban	0	2
Clearcut/Sparse	2	0
Deciduous Forest	544	0
Evergreen Forest	186	0
Mixed Forest	114	0
Row Crop/Pasture	135	0
Forested Wetland	20	0
Non-Forested Freshwater Wetland	2	0
Utility Swaths	0	14

Figure 4.61 Applicant's Proposed Project (L18-G50-PT)



4.6.2 Alternative 1 (L18-G42-PT)

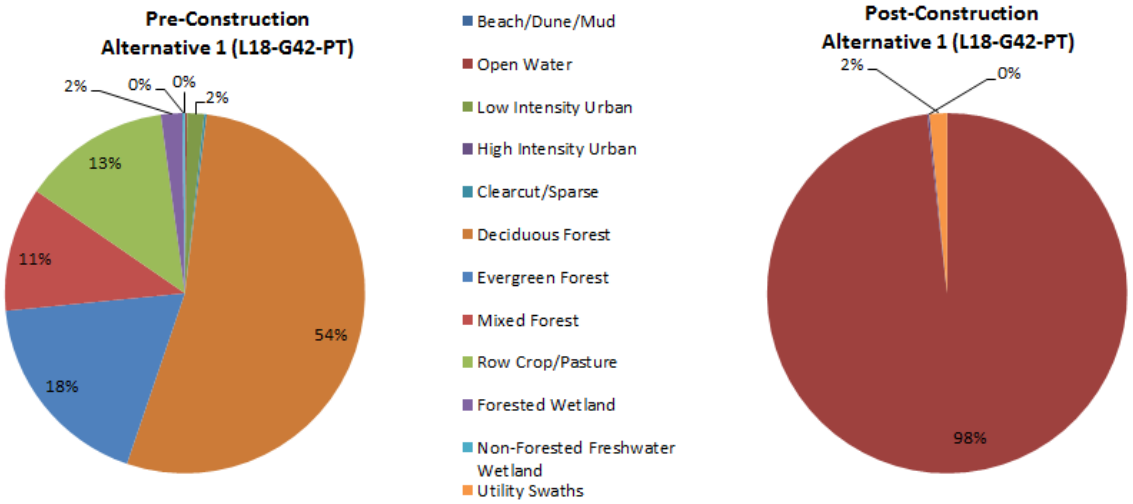
The establishment of this alternative would require the construction of the Glades Reservoir, and a water transmission system from the Chattahoochee River to the reservoir. The baseline land use of Alternative 1 primarily consists of approximately 53% deciduous forest and a mixture of evergreen forest, mixed forest, and row crop/pasture land. **Table 4.41** is an acreage breakdown of the land use changes; **Figure 4.62** shows the respective percentage change in land use.

Construction of Alterative 1 would have an impact on a total of 1018 acres of land. The land would be converted to 98% open water (1002 acres), 2% utility swaths (16 acres), and 2 acres of high intensity urban.

Table 4.41 Alternative 1 (L18-G42-PT) Land Use Changes

	Alternative 1	
Land Use	Pre-Construction (Acres)	Post-Construction (Acres)
Beach/Dune/Mud	0	0
Open Water	2	1002
Low Intensity Urban	15	0
High Intensity Urban	0	2
Clearcut/Sparse	2	0
Deciduous Forest	544	0
Evergreen Forest	186	0
Mixed Forest	114	0
Row Crop/Pasture	135	0
Forested Wetland	20	0
Non-Forested Freshwater Wetland	2	0
Utility Swaths	0	14

Figure 4.62 Alternative 1 (L18-G42-PT)



4.6.3 Alternative 2 (L18-G42-PL)

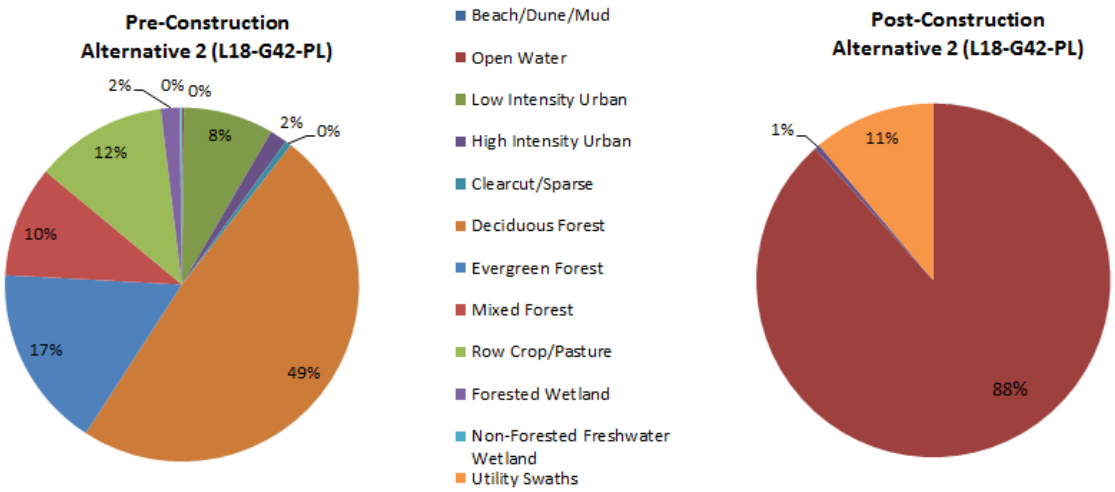
The establishment of this alternative would require the construction of the Glades Reservoir, a river water transmission system (from the Chattahoochee River to the reservoir), and a reservoir water transmission system (from the reservoir to Lakeside WTP and including a booster pump station). The baseline land use of Alternative 2 primarily consists of approximately 49% deciduous forest and a mixture of evergreen forest, mixed forest, and row crop/pasture land. **Table 4.42** is an acreage breakdown of the land use changes; **Figure 4.63** shows the respective percentage change in land use.

Construction of Alternative 2 would impact a total 1112 acres of land. The land would be converted to 88% open water (1002 acres), 11% utility swaths (104 acres), and 1% high intensity urban (6 acres).

Table 4.42 Alternative 2 (L18-G42-PL) Land Use Changes

	Alternative 2	
Land Use	Pre-Construction (Acres)	Post-Construction (Acres)
Beach/Dune/Mud	0	0
Open Water	2	1002
Low Intensity Urban	79	0
High Intensity Urban	14	6
Clearcut/Sparse	6	0
Deciduous Forest	550	0
Evergreen Forest	189	0
Mixed Forest	115	0
Row Crop/Pasture	135	0
Forested Wetland	20	0
Non-Forested Freshwater Wetland	2	0
Utility Swaths	0	104

Figure 4.63 Alternative 2 (L18-G42-PL)



4.6.4 Alternative 3 (L18-G42-WTP)

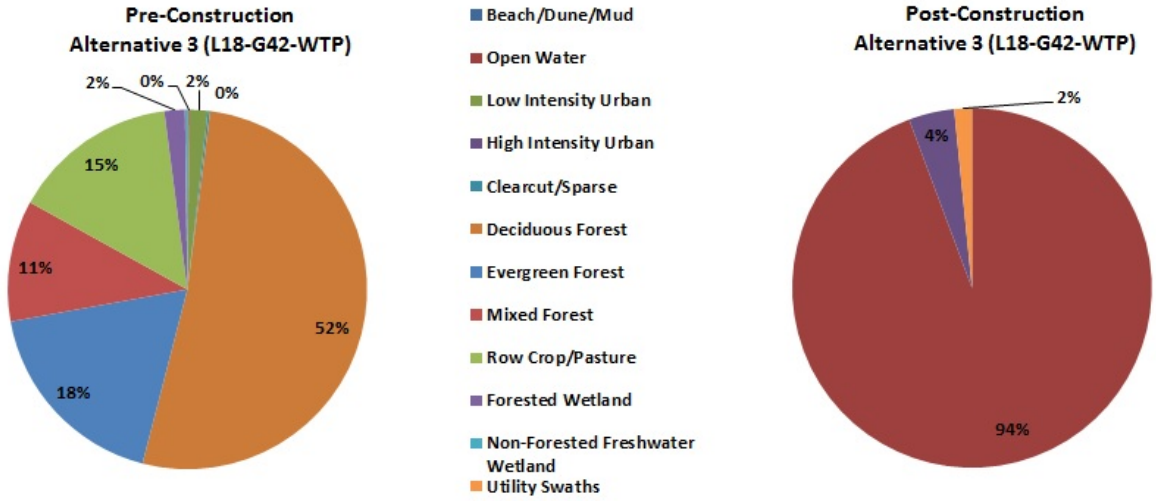
The establishment of this alternative would require the construction of the Glades Reservoir, a river water transmission system from the Chattahoochee River to the reservoir, and a new WTP at the reservoir. The baseline land use of Alternative 3 primarily consists of approximately 53% deciduous forest and a mixture of evergreen forest, mixed forest, and row crop/pasture land. **Table 4.43** is an acreage breakdown of the land use changes; **Figure 4.64** shows the respective percentage of change in land use.

Construction of Alternative 3 would impact a total of 1061 acres of land. The land would be converted to 94% open water (1002 acres), 4% high intensity urban (44 acres), and 2% utility swaths (15 acres).

Table 4.43 Alternative 3 (L18-G42-WTP) Land Use Changes

	Alternative 3	
Land Use	Pre-Construction (Acres)	Post-Construction (Acres)
Beach/Dune/Mud	0	0
Open Water	2	1002
Low Intensity Urban	17	0
High Intensity Urban	0	44
Clearcut/Sparse	2	0
Deciduous Forest	552	0
Evergreen Forest	192	0
Mixed Forest	116	0
Row Crop/Pasture	158	0
Forested Wetland	20	0
Non-Forested Freshwater Wetland	2	0
Utility Swaths	0	15

Figure 4.64 Alternative 3 (L18-G42-WTP)



4.6.5 Alternative 4 (L30-G30-PT)

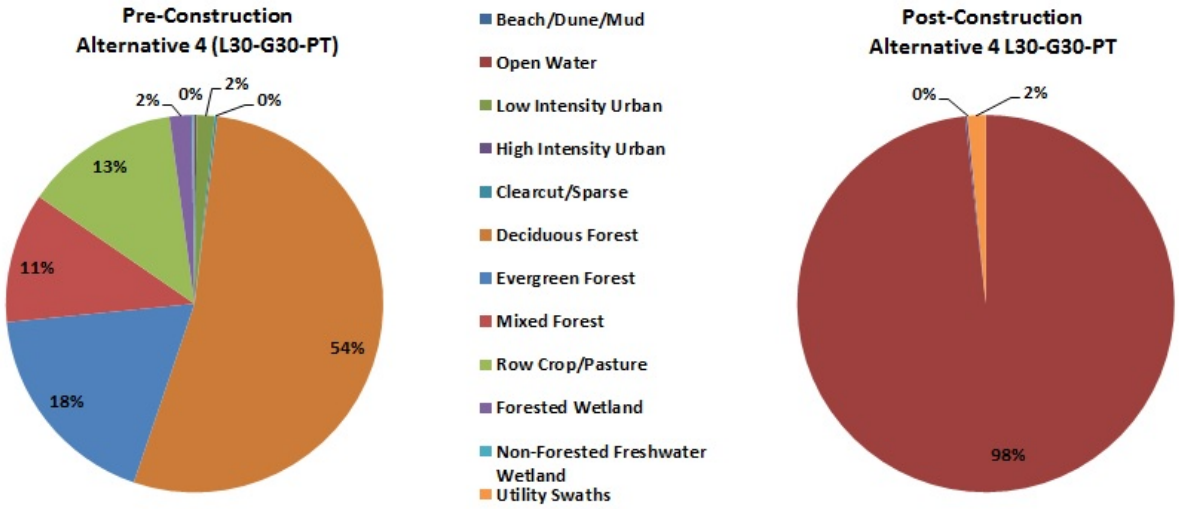
The establishment of this alternative would require the construction of the Glades Reservoir, as well as a river water transmission system. The baseline land use of Alternative 4 primarily consists of approximately 54% deciduous forest and a mixture of evergreen forest, mixed forest, and row crop/pasture land. **Table 4.44** is an acreage breakdown of the land use changes; **Figure 4.65** shows the respective percentage of change in land use.

Construction of Alternative 4 would have an impact on a total 1018 acres of land. The land would be converted to 98% open water (1002 acres), 2% utility swaths (14 acres), and 2 acres of high intensity urban.

Table 4.44 Alternative 4 (L30-G30-PT) Land Use Changes

	Alternative 4	
Land Use	Pre-Construction (Acres)	Post-Construction (Acres)
Beach/Dune/Mud	0	0
Open Water	2	1002
Low Intensity Urban	15	0
High Intensity Urban	0	2
Clearcut/Sparse	2	0
Deciduous Forest	544	0
Evergreen Forest	186	0
Mixed Forest	114	0
Row Crop/Pasture	135	0
Forested Wetland	20	0
Non-Forested Freshwater Wetland	2	0
Utility Swaths	0	14

Figure 4.65 Alternative 4 (L30-G30-PT)



4.6.6 Alternative 5 (L30-G30-PL)

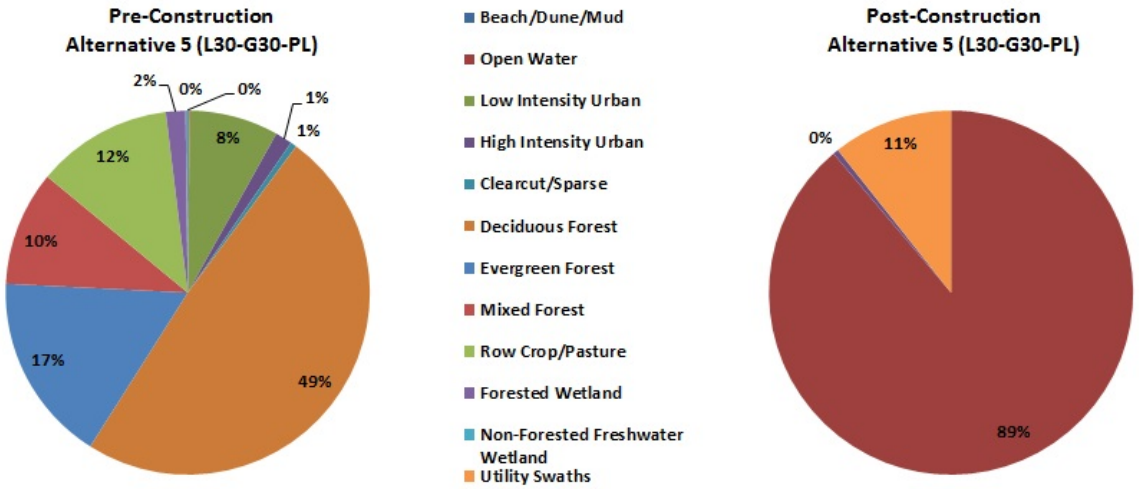
The establishment of this alternative would require the construction of the Glades Reservoir, a river water transmission system, and a reservoir water transmission system. The baseline land of Alternative 5 primarily consists of approximately 49% deciduous forest and a mixture of evergreen forest, mixed forest, and row crop/pasture land. **Table 4.45** is an acreage breakdown of the land use changes; **Figure 4.66** shows the respective percentage of change in land use.

Construction of Alternative 5 would have an impact on a total of 1112 acres. The land would be converted to 89% open water (1002 acres), 11% utility swaths (104 acres) and 6 acres of high intensity urban.

Table 4.45 Alternative 5 (L30-G30-PL) Land Use Changes

	Alternative 5	
Land Use	Pre-Construction (Acres)	Post-Construction (Acres)
Beach/Dune/Mud	0	0
Open Water	2	1002
Low Intensity Urban	79	0
High Intensity Urban	14	6
Clearcut/Sparse	6	0
Deciduous Forest	550	0
Evergreen Forest	189	0
Mixed Forest	115	0
Row Crop/Pasture	135	0
Forested Wetland	20	0
Non-Forested Freshwater Wetland	2	0
Utility Swaths	0	104

Figure 4.66 Alternative 5 (L30-G30-PL)



4.6.7 Alternative 6 (L30-G30-WTP)

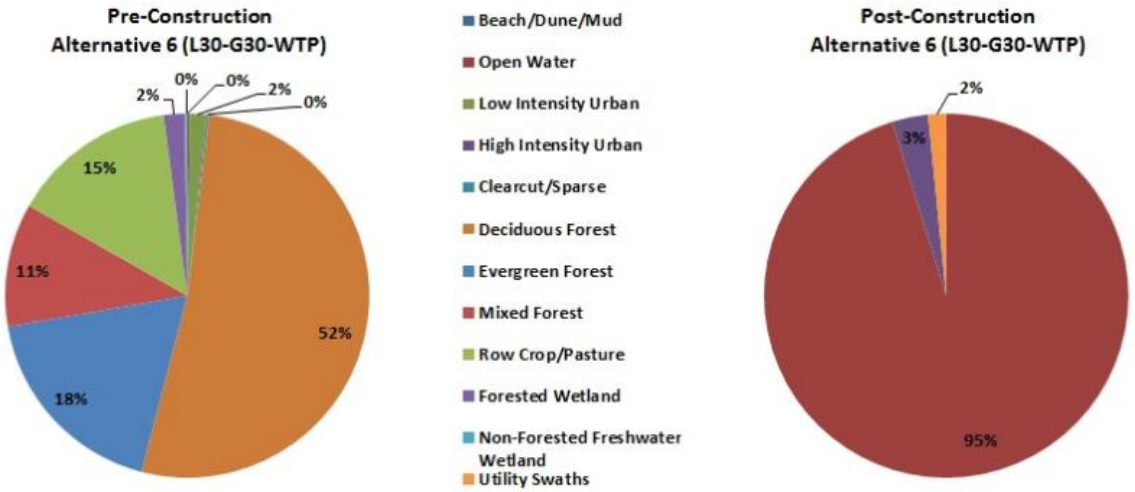
The establishment of this alternative would require the construction of the Glades Reservoir, a raw water pump station, a river water transmission system, and a new WTP. The baseline land of Alternative 6, primarily consist of approximately 52% deciduous forest and a mixture of evergreen forest, mixed forest, and row crop/pasture land. **Table 4.46** is an acreage breakdown of the land use changes; **Figure 4.67** shows the respective percentage of change in land use.

Construction of Alternative 6 would have an impact on a total of 1051 acres of land. The land would be converted to 95% open water (1002 acres), 3% high intensity urban (34 acres), and 2% utility swaths (15 acres).

Table 4.46 Alternative 6 (L30-G30-WTP) Land Use Changes

	Alternative 6	
Land Use	Pre-Construction (Acres)	Post-Construction (Acres)
Beach/Dune/Mud	0	0
Open Water	2	1002
Low Intensity Urban	17	0
High Intensity Urban	0	34
Clearcut/Sparse	2	0
Deciduous Forest	552	0
Evergreen Forest	192	0
Mixed Forest	116	0
Row Crop/Pasture	158	0
Forested Wetland	20	0
Non-Forested Freshwater Wetland	2	0
Utility Swaths	0.0	15

Figure 4.67 Alternative 6 (L30-G30-WTP)



4.6.8 Alternative 7 (L43-G17-PT)

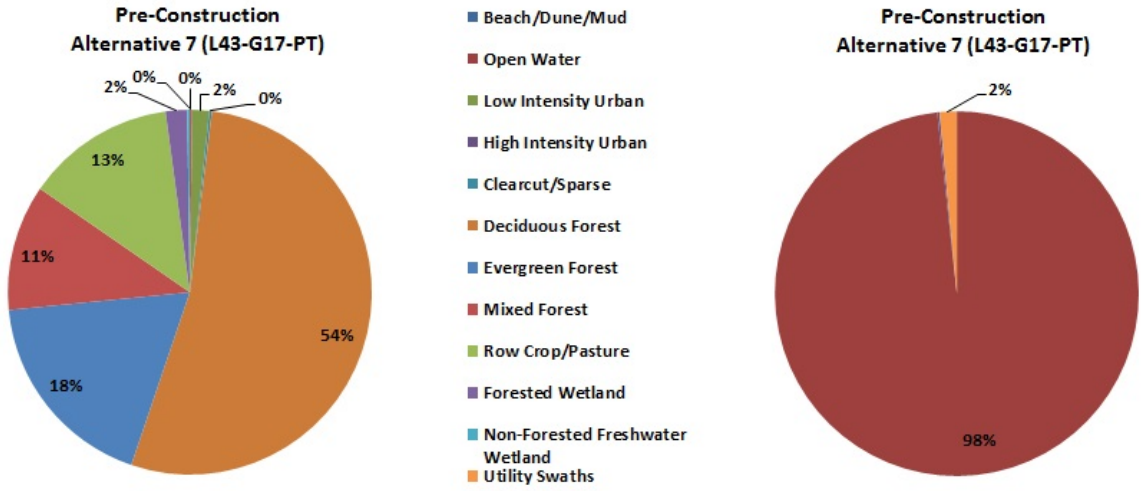
The establishment of this alternative would require the construction of the Glades Reservoir and a river water transmission system. The baseline land of Alternative 7 primarily consists of approximately 54% deciduous forest and a mixture of evergreen forest, mixed forest, and row crop/pasture land. **Table 4.47** is an acreage breakdown of the land use changes; **Figure 4.68** shows the respective percentage of change in land use.

Construction of Alternative 7 would impact a total of 1018 acres of land. The land would be converted to 98% open water (1002 acres), 2% utility swaths (14 acres) and 2 acres of high intensity urban.

Table 4.47 Alternative 7 (L43-G17-PT) Land Use Changes

	Alternative 7	
Land Use	Pre-Construction (Acres)	Post-Construction (Acres)
Beach/Dune/Mud	0	0
Open Water	2	1002
Low Intensity Urban	15	0
High Intensity Urban	0	2
Clearcut/Sparse	2	0
Deciduous Forest	544	0
Evergreen Forest	186	0
Mixed Forest	114	0
Row Crop/Pasture	135	0
Forested Wetland	20	0
Non-Forested Freshwater Wetland	2	0
Utility Swaths	0	14

Figure 4.68 Alternative 7 (L43-G17-PT)



4.6.9 Alternative 8 (L43-G17-PL)

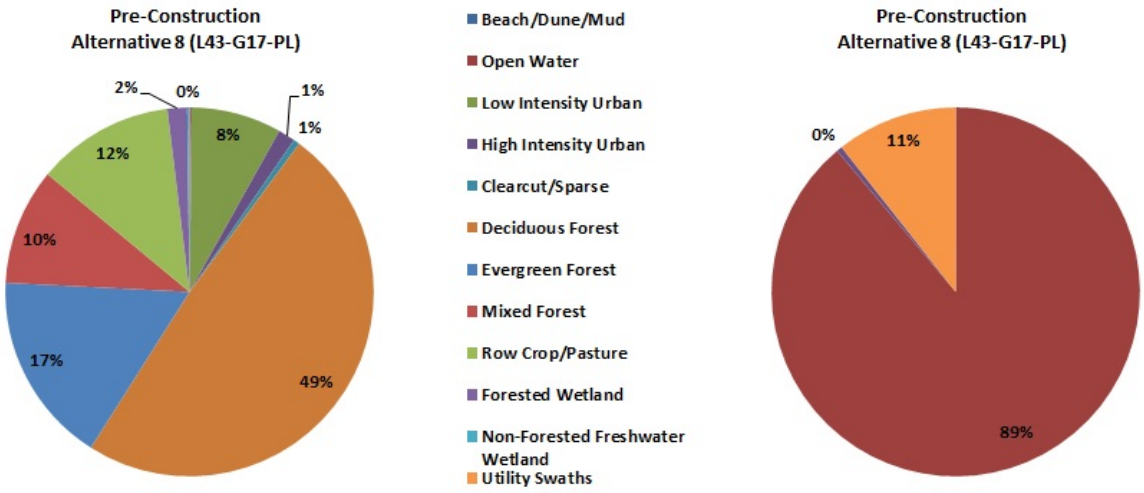
The establishment of this alternative would require the construction of the Glades Reservoir, a river water transmission system, and a reservoir water transmission system to Lakeside WTP. The baseline land of Alternative 8 primarily consists of approximately 49% deciduous forest and a mixture of evergreen forest, mixed forest, and row crop/pasture land. **Table 4.48** is an acreage breakdown of the land use changes; **Figure 4.69** shows the respective percentage of change in land use.

Construction of Alternative 8 would impact a total of 1112 acres of land. The land would be converted to 89% open water (1002 acres), 11% utility swaths (104 acres) and 6 acres of high intensity urban.

Table 4.48 Alternative 8 (L43-G17-PL) Land Use Changes

	Alternative 8	
Land Use	Pre-Construction (Acres)	Post-Construction (Acres)
Beach/Dune/Mud	0	0
Open Water	2	1002
Low Intensity Urban	79	0
High Intensity Urban	14	6
Clearcut/Sparse	6	0
Deciduous Forest	550	0
Evergreen Forest	189	0
Mixed Forest	115	0
Row Crop/Pasture	135	0
Forested Wetland	20	0
Non-Forested Freshwater Wetland	2	0
Utility Swaths	0	104

Figure 4.69 Alternative 8 (L43-G17-PL)



4.6.10 Alternative 9 (L43-G17-WTP)

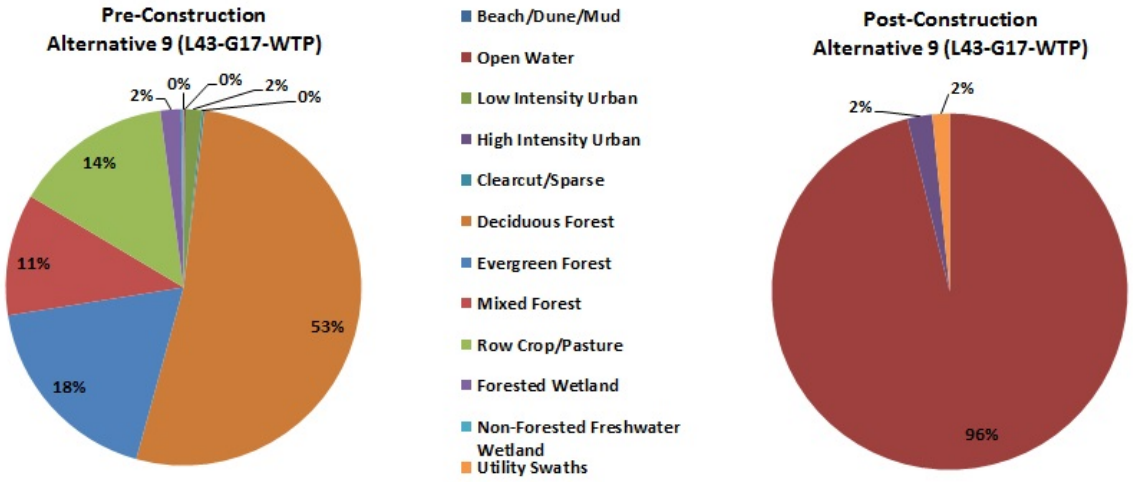
The establishment of this alternative would require the construction of the Glades Reservoir, a river water transmission system, and a new WTP. The baseline land use of Alternative 9 primarily consists of approximately 53% deciduous forest and a mixture of evergreen forest, mixed forest, and row crop/pasture land. **Table 4.49** is an acreage breakdown of the land use changes; **Figure 4.70** shows the respective percentage of change in land use.

Construction of Alternative 9 would impact a total of 1041 acres of land. The land would be converted to 96% open water (1002 acres), 2% high intensity urban (24 acres), and 2% utility swaths (15 acres).

Table 4.49 Alternative 9 (L43-G17-WTP) Land Use Changes

	Alternative 9	
Land Use	Pre-Construction (Acres)	Post-Construction (Acres)
Beach/Dune/Mud	0	0
Open Water	2	1002
Low Intensity Urban	17	0
High Intensity Urban	0	24
Clearcut/Sparse	2	0
Deciduous Forest	552	0
Evergreen Forest	192	0
Mixed Forest	116	0
Row Crop/Pasture	158	0
Forested Wetland	20	0
Non-Forested Freshwater Wetland	2	0
Utility Swaths	0.0	15

Figure 4.70 Alternative 9 (L43-G17-WTP)



4.6.11 Alternative 10 (L43-W17-PT)

The establishment of this alternative would require the construction of the White Creek Reservoir and a river water transmission system. The baseline land of Alternative 10 primarily consists of approximately 53% deciduous forest and a mixture of evergreen forest, mixed forest, and row crop/pasture land. **Table 4.50** is an acreage breakdown of the land use changes; **Figure 4.71** shows the respective percentage of change in land use.

Construction of Alternative 10 would impact a total 667 acres of land. The land would be converted to approximately 99% open water (663 acres), 1% utility swaths (2 acres), and 2 acres of high intensity urban.

Table 4.50 Alternative 10 (L43-W17-PT) Land Use Changes

	Alternative 10	
Land Use	Pre-Construction (Acres)	Post-Construction (Acres)
Beach/Dune/Mud	1	0
Open Water	30	663
Low Intensity Urban	17	0
High Intensity Urban	1	2
Clearcut/Sparse	31	0
Deciduous Forest	357	0
Evergreen Forest	53	0
Mixed Forest	61	0
Row Crop/Pasture	85	0
Forested Wetland	31	0
Non-Forested Freshwater Wetland	0	0
Utility Swaths	0	2

Figure 4.71 Alternative 10 (L43-W17-PT)

4.6.12 Alternative 11 (L43-W17-PL)

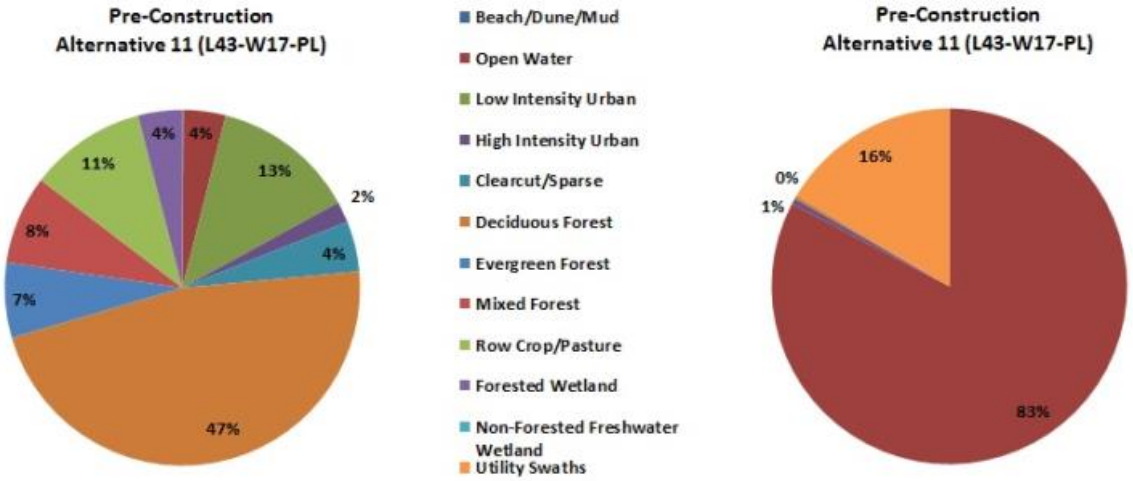
The establishment of this alternative would require the construction of the White Creek Reservoir, a river water transmission system, and a reservoir water transmission system from White Creek to Lakeside WTP. The baseline land use of Alternative 11 primarily consists of approximately 47% deciduous forest and a mixture of evergreen forest, low intensity urban, and row crop/pasture land. **Table 4.51** is an acreage breakdown of the land use changes; **Figure 4.72** shows the respective percentage of change in land use.

Construction of the Alternative 11 would impact a total of 785 acres land. The land would be converted to 83% open water (663 acres), 1% high intensity urban (7 acres), and 16% utility swaths (115 acres).

Table 4.51 Alternative 11 (L43-W17-PL) Land Use Changes

	Alternative 11	
Land Use	Pre-Construction (Acres)	Post-Construction (Acres)
Beach/Dune/Mud	1	0
Open Water	30	663
Low Intensity Urban	93	0
High Intensity Urban	13	7
Clearcut/Sparse	37	0
Deciduous Forest	371	0
Evergreen Forest	55	0
Mixed Forest	63	0
Row Crop/Pasture	90	0
Forested Wetland	31	0
Non-Forested Freshwater Wetland	0	0
Utility Swaths	0	115

Figure 4.72 Alternative 11 (L43-W17-PL)



4.6.13 No Action – L60

The No Action Alternative would result in no new construction for water supply infrastructure other than the expansion of Lakeside WTP to treat water withdrawn from Lake Lanier; therefore, there is no change in land use.

4.6.14 Road Impacts

The construction of a reservoir will impact current roads traveling through areas that will be flooded (discussed in detail in Section 4.8). Some of these roads may be terminated, some will end in a cul-de-sac, some re-routed, and a few will have a bridge replacement. New access roads will be constructed for maintenance of the water supply infrastructure. **Table 4.52** summarizes the land use changes associated with road relocation and replacement. For Glades Reservoir, approximately 28 acres will be impacted due to new road construction and relocation. For White Creek Reservoir, approximately 21 acres will be impacted.

Table 4.52 Land Use Changes from Road Relocation and Replacement

	Glades Reservoir		White Creek Reservoir	
Land Use	%	Acres	%	Acres
Open Water	0%	0.0	3%	0.7
Low Intensity Urban	8%	2.2	24%	4.9
High Intensity Urban	0%	0.0	1%	0.2
Clearcut/Sparse	3%	0.9	3%	0.7
Deciduous Forest	26%	7.3	45%	9.4
Evergreen Forest	51%	14.2	4%	0.9
Mixed Forest	10%	2.7	6%	1.3
Row Crop/Pasture	2%	0.7	13%	2.7

4.6.15 Topography Impacts

The potential land surface disturbance and alteration would result in effects on topography (Table 4.39). The potential effects are evaluated based on the total disturbed area. For both proposed reservoir sites, water would be drained from higher to lower elevations and into the streams and tributaries in the watershed, and eventually into the reservoir. The natural topography or watershed for either Flat Creek or White Creek would not be changed for the No Action Alterative. The majority of the topography in the Flat Creek and White Creek watershed would not be changed except for the areas directly affected by the proposed construction. However, the benefit of a reservoir is that water from the watershed would be captured and stored in all the reservoir alternatives.

4.7 Energy Needs and Climate (Greenhouse Gas)

Chapter 3 includes a detailed discussion of greenhouse gases (GHG). Carbon dioxide (CO_2) is the primary GHG emitted through human activities. Human activities influence the ability of natural sinks, like forests, to remove CO_2 from the atmosphere. The way in which people use land can affect the amount of CO_2 in the atmosphere, especially when it involves deforestation and energy usage (www.epa.gov/climatechange/ghgemissions/gases/co2.html).

Loss of forested land means less CO_2 is removed from the atmosphere. One acre of average U.S. forest is estimated to sequester approximately 1.22 metric ton of CO_2 on an annual basis (*Inventory of U.S. Greenhouse Gas Emission and Sinks: 1990-2010*, EPA 430-R-12-001).

In addition, pumping of water contributes to energy consumption and CO_2 emission. To estimate CO_2 emission caused by the production of energy required for pumping, the energy needs for all alternatives are first estimated based annual average pumping quantity, static (elevation different) and friction loss occurred in the transmission mains over the distance for pumping, and a typical pump efficiency coefficient. Emissions from electricity consumption are estimated based on an emission factor of 6.89551 × 10-4 metric tons CO_2/kilowatt-hour (kWh) of power consumption. Emissions calculations are based on data provided in the Environmental Protection Agency's (EPA) GHG emissions website http://www.epa.gov/cleanenergy/energy-resources/refs.html

Plants absorb CO_2 as they grow, removing it from the atmosphere. Removing CO_2 from the atmosphere is known as sequestration. Forests are considered natural greenhouse gas "sinks" because of their ability to absorb or store CO_2.

4.7.1.1 Impacts of Proposed Project and Alternatives

The Proposed Project and alternatives reduce the potential for removal of CO_2 in the atmosphere because of the impact to forested land; in addition, energy consumption from pumping would contribute to CO_2. The changes to forested land are detailed in section 4.5 Land Use. The following describes the impact of these changes on CO_2 sequestration, as well as contributions to CO_2 emissions from electricity consumption, for the Glades Reservoir and White Creek Reservoir alternatives. The No Action Alternative would have the lowest overall CO_2 emission contribution because no forested land is lost due to the reservoir inundation and no additional pumping is required.

Glades Reservoir Alternatives

CO_2 Sequestration

The impacts to forested areas that would occur from construction of the Glades Reservoir alternatives, due to the removal of trees, are considered long-term indirect impacts. **Table 4.53** details the forested areas impacted and potential reduction of CO_2 sequestration for each alternative.

As a comparison, the reduction of CO_2 sequestration from these alternatives is approximately 5% (or 1/20) of the total CO_2 metric tons emissions of the smallest Facility Level Information on Greenhouse

Gases Tool (FLIGHT) facility in Hall County and approximately 1% (or 1/85) of the total CO_2 from the largest FLIGHT facility in Hall County.

It is important to note that the proposed use of the Glades Reservoir land was originally intended for silviculture and lumber purposes; as such, impacts to GHG would also be likely, but would depend on the rotation of the harvest that could have a variable effect on GHG.

CO_2 Emissions

Among the alternatives evaluated, the Glades Reservoir alternatives that require pumping from a new reservoir to Lakeside WTP (PL Alternatives 2, 5, and 8) would contribute the highest level of CO_2 emissions, followed by pumping to a new WTP near the reservoir (WTP Alternative 3, 6, 9). The energy requirement is the lowest, thus lowest CO_2 emission contribution, when stored water is released into the creek to "pass through" Lake Lanier before treatment (PT Alternatives 1, 4, and 7). **Table 4.53** details the CO_2 emissions from pumping for each alternative.

White Creek Reservoir Alternatives

CO_2 Sequestration

The impacts to forested lands that would occur from components of the White Creek Reservoir alternatives are considered long-term indirect impacts. **Table 4.53** details the forested areas impacted and potential reduction of CO_2 sequestration for each alternative.

As a comparison, the reduction of CO_2 sequestration of these alternatives is approximately 3% of the total CO_2 metric tons emissions of the smallest FLIGHT facility in Hall County and 0.7 % of the total CO_2 from the largest FLIGHT facility in Hall County.

CO_2 Emissions

The White Creek Reservoir Alternative 11 requires pumping from a new reservoir to Lakeside WTP and, along with Glades Reservoir Alternatives 2, 5, and 8 would contribute the highest level of CO_2 emissions. Alternative 10 is a "pass through" alternative and, along with Glades Reservoir Alternatives 1, 4, and 7 has the lowest CO_2 emission contribution. **Table 4.53** details the CO_2 emissions from pumping for each alternative.

Table 4.53 provides a summary of estimated GHG emission impacts estimated based on the methodologies described above.

Table 4.53 GHG Impacts

Alternative #	Alternative ID	Forest Area Impacted (acres)	Potential Reduction of CO_2 Sequestration (metric tons)*	Pumping Emissions CO_2 (metric tons)	Type of Impact to GHG
Applicant	L18-G50-PT	886	1,081	11,761,	Long Term Adverse Impacts
1	L18-G42-PT	886	1,081	8,895	Long Term Adverse Impacts
2	L18-G42-PL	897	1,095	23,138	Long Term Adverse Impacts
3	L18-G42-WTP	904	1,102	14,126	Long Term Adverse Impacts
4	L30-G30-PT	886	1,081	5,136	Long Term Adverse Impacts
5	L30-G30-PL	897	1,095	14,927	Long Term Adverse Impacts
6	L30-G30-WTP	899	1,096	8,742	Long Term Adverse Impacts
7	L43-G17-PT	886	1,081	954	Long Term Adverse Impacts
8	L43-G17-PL	897	1,095	7,252	Long Term Adverse Impacts
9	L43-G17-WTP	894	1,090	3,365	Long Term Adverse Impacts
10	L43-W17-PT	515	628	2,011	Long Term Adverse Impacts
11	L43-W17-PL	533	650	10,011	Long Term Adverse Impacts
No Action	L60	0	0	0	Long Term Adverse Impacts

*Emissions calculations based on data provided in EPA's GHG emissions website http://www.epa.gov/cleanenergy/energy-resources/refs.html . Electricity emissions factors are based on 6.89551 × 10-4 metric tons CO_2/kWh of power consumption. Acres of forest sequestration factors are associated with -1.22 metric ton CO_2 sequestered annually by one acre of average U.S. forest.

4.7.1.2 Unavoidable Adverse Impacts

The Proposed Project and alternatives would not result in a major impact to GHG. Changes to forested land would result in minor reductions of CO_2 sequestration. These reductions would be considered long-term impacts due to the permanent removal of forest, but would not be considered adverse.

The CO_2 emissions resulting from pumping operations are considered long-term indirect impacts.

The emissions contributions from pumping range from 954 metric tons (Alternative 7) of CO_2 annually to 23,138 metric tons (Alternative 2) of CO_2 annually. To put this into perspective, 23,138 metric tons of CO_2 (highest alternative level) is equivalent to emissions from 5,087 passenger vehicles per year. Based on population projections (see **Appendix C**) and average vehicles per household (U.S. Department of Transportation statistics), the number of vehicles in Hall County is projected to increase from 2,805 per year (2010-2015) to 17,460 per year (2055-2060).

4.7.1.3 Mitigation and Monitoring

No mitigation and monitoring are proposed for any of the alternatives, since additional GHG as a result of project implementation would be transmitted into the atmosphere at levels relatively consistent with activities from anticipated population growth.

4.8 Biological Resources

All water supply infrastructure components evaluated in this DEIS are located within ACF River Basin and the Southern Inner Piedmont ecoregion. The construction and operation of each alternative would create similar direct and indirect impact types for all of the general biological resources within the basin and ecoregion.

Chapter 3 evaluates the existing conditions of biological resources in the rivers, tributaries, and wetlands for the alternative reservoir sites and associated transmission systems located within Hall, White, and Habersham counties in Georgia. This section discusses the impact on the following biological resources:

- Upland Vegetation
- Wetlands, Streams, and Other Waters
- Wildlife

4.8.1 Upland Vegetation

The construction of all reservoir alternatives would directly impact and result in permanent loss of all upland vegetative communities within the footprints of the reservoir, water transmission mains, and other infrastructure (pump stations, new WTP, and road relocation). Construction activities such as tree clearing, grubbing, and land grading would temporarily remove all plant species, while flooding of the reservoir area would permanently alter the habitat. Re-vegetation within the reservoir footprints would not be possible. In addition, all action alternatives would require a right-of-way (ROW) easement for the transmission main from the Chattahoochee River to the potential reservoir and Alternatives 2, 5, 8, and 10 would require a ROW easement for the transmission main from the reservoir to the Lakeside WTP. The permanent easement (or ROW) corridors are assumed to be 30 feet, regardless of the recommended pipe size for each alternative. Estimated impacts to all vegetative communities are based on the GLUT database.

Areas of upland vegetation are not regulated by federal or state agencies and impacts would not require permitting, except by local ordinances if applicable.

4.8.1.1 Summary of Impacts for All Alternatives

Approximately 898 acres of vegetated areas are located within the Glades Reservoir alternatives. Approximately 74% of the river and reservoir water transmission systems for the Glades Reservoir will occur in vegetated areas. Approximately 617 acres of vegetated areas are located within the White Creek alternatives. Approximately 50% of the river and reservoir water transmission systems for White

Creek Reservoir will occur in vegetated areas. Invasion of noxious weeds in disturbed areas is likely under all alternatives.

Table 4.54 summarizes the permanent vegetative community impacts by alternative.

Table 4.54 Permanent Impacts on Vegetative Community by Alternative

Alternative #	Alternative ID	Land Use Category	Reservoir (acres)	River Transmission System (acres)	Reservoir Transmission System[1] (acres)	Road Impacts (acres)	Total Impacts (acres)
Applicant	L18-G50-PT	Relatively Unvegetative Areas[2]	14	5	---	8	27
		Relatively Vegetative Areas[3]	988	9	---	25	1022
1	L18-G42-PT	Relatively Unvegetative Areas[2]	14	5	---	8	27
		Relatively Vegetative Areas[3]	988	9	---	25	1022
2	L18-G42-PL	Relatively Unvegetative Areas[2]	14	5	81	8	108
		Relatively Vegetative Areas[3]	988	9	9	25	1031
3	L18-G42-WTP	Relatively Unvegetative Areas[2]	14	5	---	8	27
		Relatively Vegetative Areas[3]	988	9	---	25	1022
4	L30-G30-PT	Relatively Unvegetative Areas[2]	14	5	---	8	27
		Relatively Vegetative Areas[3]	988	9	---	25	1022
5	L30-G30-PL	Relatively Unvegetative Areas[2]	14	5	81	8	108
		Relatively Vegetative Areas[3]	988	9	9	25	1031
6	L30-G30-WTP	Relatively Unvegetative Areas[2]	14	5	---	8	27
		Relatively Vegetative Areas[3]	988	9	---	25	1022
7	L43-G17-PT	Relatively Unvegetative Areas[2]	14	5	---	8	27
		Relatively Vegetative Areas[3]	988	9	---	25	1022
8	L43-G17-PL	Relatively Unvegetative Areas[2]	14	5	81	8	108
		Relatively Vegetative Areas[3]	988	9	9	25	1031
9	L43-G17-WTP	Relatively Unvegetative Areas[2]	14	5	---	8	27
		Relatively Vegetative Areas[3]	988	9	---	25	1022
10	L43-W17-PT	Relatively Unvegetative Areas[2]	79	0	---	7	86
		Relatively Vegetative Areas[3]	581	2	---	14	597
11	L43-W17-PL	Relatively Unvegetative Areas[2]	79	0	92	7	178
		Relatively Vegetative Areas[3]	581	2	20	14	617
No Action[3]	L60	Relatively Vegetative and Unvegetative Areas	---	---	----	----	0

[1] Data based on land use categories indicated in the Land Use section.

[2] Data based on the following land use categories: open water, low/high intensity urban, clearcut/sparse, quarries/strip mines/rock outcrop areas. Vegetation in these areas is typically disturbed, removed, or absent. Grouping these GLUT categories allows for a simplified comparison of relatively unvegetated areas versus those

containing either existing vegetation or areas that are able to reestablish vegetative cover. Relatively unvegetated areas is not a GLUT category.

[3] Data based on the following land use categories: deciduous forest, evergreen forest, mixed forest, row crop/pasture, forested wetland, and non-forested freshwater wetland.

4.8.1.2 Mitigation and Monitoring

Where practicable, the river and reservoir transmission systems have been conceptually designed to minimize environmental impacts. Transmission main alignments were selected to follow existing ROW as much as possible to avoid additional undisturbed areas.

Impacts to vegetation would be minimized during the construction and final stabilization phases of the project. Mitigation for impacts to vegetation would include re-vegetating areas temporarily disturbed during construction and re-vegetating project features, such as dam embankments, road shoulders, and transmission main ROWs. Although there would be a permanent change to any existing vegetative communities located within the transmission main ROW corridors, herbaceous revegetation of the ROW corridor would result in a row crop/pastureland habitat. Due to required maintenance and protection of the water mains, the corridor would not be allowed to regenerate shrub, sapling, or canopy species.

During the construction and final stabilization phases of the project, additional mitigation measures would be taken to prevent or minimize the spread of Category 1 exotic plant species (**Table 4.55**). These measures would include removing and disposing of vegetative parts in the soil that may reproduce by root raking, prior to moving the soil; burning on site any such parts and above ground parts that bear fruit; controlling or eradicating infestations prior to construction; and cleaning vehicles and other equipment prior to leaving the infested site.

Category 1 exotic plant species pose a serious problem in Georgia natural areas by extensively invading native plant communities and displacing native species.

Table 4.55 Category 1 Exotic Plant Species

Scientific Name	Common Name
Ailanthus altissima (P. Mill.) Swingle	tree-of-heaven
Albizia julibrissin Durazz.	mimosa
Alternanthera philoxeroides (Mart.) Griseb.	alligatorweed
Eichhornia crassipes (Mart.) Solms	common water hyacinth
Elaeagnus umbellata Thunb.	autumn olive
Hedera helix L.	English ivy
Hydrilla verticillata (L. f.) Royle	hydrilla
Lespedeza bicolor Turcz.	shrubby lespedeza
Lespedeza cuneata (Dum.-Cours.) G. Don	sericea lespedeza
Ligustrum sinense Lour.	Chinese privet
Lonicera japonica Thunb.	Japanese honeysuckle
Lygodium japonicum (Thunb. ex Murr.) Sw.	Japanese climbing fern
Melia azedarach L.	chinaberry
Microstegium vimineum (Trin.) A. Camus	Japanese stiltgrass
Murdannia keisak (Hassk.) Hand.-Maz.	marsh dayflower
Paulownia tomentosa (Thunb.) Sieb. & Zucc. ex Steud.	princesstree
Pueraria montana var. lobata (Willd.) Maesen & S. Almeida	kudzu
Rosa multiflora Thunb.	multiflora rose
Triadica sebifera (L.) Small	Chinese tallowtree
Wisteria sinensis (Sims) DC.	Chinese wisteria

4.8.1.3 Unavoidable Adverse Impacts

Unavoidable impacts would occur to upland vegetation; however, these impacts are not considered adverse.

4.8.2 Wetlands, Streams, and Other Waters

4.8.2.1 Methodology

A Waters of the United States (WOUS) delineation of the Glades Reservoir site was performed in 2011 and the Corps verified the findings of that effort in 2012 (see **Appendix S**). This Corps-verified delineation has been used in determining impacts to WOUS by the Glades Reservoir footprint and the river transmission main. Impacts to WOUS by the Glades Reservoir transmission main and all of the White Creek Reservoir alternatives have been calculated using the best publicly available database research. Using Geographic Information System (GIS) overlays, the direct impacts to potential WOUS resulting from the Proposed Project and alternatives have been quantitatively assessed.

"WOUS" refers to wetlands, streams, and open waters (e.g., lakes and ponds) under the jurisdiction of the Corps in accordance with defining criteria outlined in Corps regulations (Part 2328 of Title 33, CFR).

4.8.2.2 Glades Reservoir Alternatives

Of the 39.2 acres of wetlands located within the Glades Reservoir, approximately 89% are classified as emergent Class 2 and Class 4 wetlands with existing adverse impacts. The 11% of remaining wetlands are classified as Class 1, fully functional emergent, scrub-shrub, and forested wetlands with little to no previously existing impacts. Creation of the reservoir's dam and subsequent flooding of the Glades

Reservoir would permanently impact all of the wetlands identified within the Glades Reservoir alternatives. Due to the duration and level of impacts, all wetland function, such as pollutant filtration and habitat for semi-aquatic and terrestrial species will be removed. However, the majority of wetlands within this footprint exhibit pre-existing adverse impacts and the quality of wetland function is already reduced due to historical agricultural practices.

Although a delineation and Corps verification has not occurred for the reservoir transmission main, no wetlands were identified within this corridor using the National Wetlands Inventory (NWI) coverage. Therefore, no wetland impacts are anticipated from the construction of any alternative within this transmission corridor.

4.8.2.3 White Creek Reservoir Alternatives

Less than half of the wetlands (46%) identified within the White Creek Reservoir footprint are listed by the NWI as flooded or ponded. The ponded wetlands are part of Webster Lake, a pre-existing impoundment of White Creek. Flooding of the White Creek Reservoir will permanently flood the remaining 25.8 acres. Although the remaining wetlands are identified by the NWI as forested or scrub/shrub wetlands, the upper portions of Webster Lake appear to contain only emergent vegetation. Similarly, within the upper reaches of White Creek in the White Creek Reservoir, forested and scrub/shrub wetlands are identified by NWI; however according to aerial imagery, a large portion of these wetlands appear to be contain only herbaceous vegetation. Distinguishing between herbaceous and scrub/shrub vegetation is problematic; without field surveys to verify the type and class of these wetlands, impacts and calculations of required mitigation have been based on the information provided by the NWI. Field surveys would be required to further identify the type and class of wetlands in this area.

4.8.2.4 Summary of Impacts for All Alternatives

The Glades Reservoir and White Creek Reservoir alternatives would both result in similar types of temporary and permanent impacts to WOUS. Temporary impacts associated with construction activities would be considered short-term. Any temporary impacts to WOUS due to construction activities would be reestablished to the pre-existing grade and re-vegetated with appropriate seeds and plantings. Prior to the start of construction, approved National Pollutant Discharge Elimination System (NPDES) Best Management Practices (BMPs) will be installed and maintained throughout the construction phase of the project in order to prevent additional sedimentation from occurring within any federal and state waters identified at any of the alternatives.

Flooding of the reservoir's footprint would result in permanent alteration of wetland soil characterization, wetland hydrology, and vegetation. Additionally, a change in the flow regime below the dam would permanently alter the stream's physical characteristics, such as its defined bed and banks and ordinary high water mark.

Impacts to Corps-verified wetlands and streams within the Glades Reservoir footprint, as well as wetlands and streams indicated on the database research for all other alternative components, are summarized in **Table 4.56** and **Table 4.57** below.

Table 4.56 Wetland Area Impacts (acres)

Alternative #	Alternative ID	Reservoir	River Water Transmission System	Permanent Impacts - Reservoir Water Transmission System[1]	Temp + Permanent Impacts – Reservoir Water Transmission System[1]
Applicant	L18-G50-PT	39.2	0	N/A	N/A
1	L18-G42-PT			N/A	N/A
2	L18-G42-PL			0.9	0.9
3	L18-G42-WTP			0	0
4	L30-G30-PT			N/A	N/A
5	L30-G30-PL			0.9	0.9
6	L30-G30-WTP			0	0
7	L43-G17-PT			N/A	N/A
8	L43-G17-PL			0.9	0.9
9	L43-G17-WTP			0	0
10	L43-W17-PT	41.4[2]	0	N/A	N/A
11	L43-W17-PL			0.8	0.8
No Action	L60	None	N/A	N/A	N/A

[1] Streams and wetlands impacted by required stream crossings for road access are included in the transmission system impact calculations.

[2] The area of Webster Lake was removed from the White Creek footprint impacts due to the land use type not changing with the implementation of the alternatives.

Table 4.57 Stream Impacts (Linear Feet)

Alternative #	Alternative ID	Reservoir	Roadways	River Water Transmission System[1]	Reservoir Water Transmission System[1]
Applicant	L18-G50-PT	94,120	0	140	N/A
1	L18-G42-PT			140	N/A
2	L18-G42-PL			140	1,750
3	L18-G42-WTP			140	N/A
4	L30-G30-PT			140	N/A
5	L30-G30-PL			140	1,750
6	L30-G30-WTP			140	N/A
7	L43-G17-PT			140	N/A
8	L43-G17-PL			140	1,750
9	L43-G17-WTP			140	N/A
10	L43-W17-PT	59,698	40	0	N/A
11	L43-W17-PL			0	2,170
No Action	L60	None	None	N/A	N/A

[1] Streams and wetlands impacted by required stream crossings for road access are included in the transmission system impact calculations.

4.8.2.5 Mitigation and Monitoring

Compensatory mitigation involves taking actions to offset unavoidable adverse impacts to wetlands, streams, and other aquatic resources authorized by Clean Water Act (CWA) Section 404 permits and other Department of the Army (DA) permits. For impacts authorized under Section 404, compensatory mitigation is not considered until after all appropriate and practicable steps have been taken to first avoid and then minimize adverse impacts to the aquatic ecosystem, pursuant to 40 CFR Part 230 (i.e., the CWA Section 404(b)(1) guidelines, 33 CFR Parts 325 and 332, available at http://www.usace.army.mil/Portals/2/docs/civilworks/regulatory/final_mitig_rule.pdf)

The screening process described in Chapter 2 details the efforts utilized for avoiding and minimizing impacts to aquatic ecosystems while still meeting the need and purpose of the project. At this stage of development, the project intends to purchase mitigation credits from multiple Corps-approved mitigation banks located within the Upper Chattahoochee River Watershed (Hydrologic Unit Code [HUC] 03130001). Due to the project's size and the potential to impact multiple reaches of streams, the project will be required to acquire credits from mitigation banks' primary service areas and through the in-lieu fee program. As of this writing, there are not enough stream credits currently available or predicted to be released. Based on the April 10, 2008 Final Compensatory Mitigation Rule, the project may supplement the remaining mitigation by making payments into a Corps approved in-lieu fee mitigation program (e.g., Georgia Land Trust) if the required mitigation credits are not available within the Upper Chattahoochee River Watershed. In order to calculate the required in-lieu fee credits, the appropriate conversion factors will be implemented at the time of purchase.

Table 4.58 Wetland and Open Water Mitigation – Estimated Credits Required by Water Supply Infrastructure Components

Alternative #	Alternative ID	Reservoir Site	River Water Transmission System	Reservoir Water Transmission System	WTP (new or expansion)	Roadway Relocation or Replacements	Total
Applicant	L18-G50-PT	245	0	NA	NA	0	245.0
1	L18-G42-PT		0	NA	NA	0	245.0
2	L18-G42-PL		0	3.7	NA	0	248.7
3	L18-G42-WTP		0	NA	0	0	245.0
4	L30-G30-PT		0	NA	NA	0	245.0
5	L30-G30-PL		0	3.7	NA	0	248.7
6	L30-G30-WTP		0	NA	0	0	245.0
7	L43-G17-PT		0	NA	NA	0	245.0
8	L43-G17-PL		0	3.7	NA	0	248.7
9	L43-G17-WTP		0	NA	0	0	245.0
10	L43-W17-PT	315	0	NA	NA	0	315.0
11	L43-W17-PL		0	3.6	NA	0	318.6
No Action	L60	None	NA	NA	NA	0	0.0

Table 4.59 Stream Mitigation – Stream Credits Required

Alternative #	Alternative ID	Reservoir Footprint	River Water Transmission System	Reservoir Water Transmission System	WTP (new or expansion)	Roadway	Total
Applicant	L18-G50-PT	677,630	365	NA	NA	NA	677,995
1	L18-G42-PT		365	NA	NA	NA	677,995
2	L18-G42-PL		365	4,322	NA	NA	682,317
3	L18-G42-WTP		365	NA	0	NA	677,995
4	L30-G30-PT		365	NA	NA	NA	677,995
5	L30-G30-PL		365	4,322	NA	NA	682,317
6	L30-G30-WTP		365	NA	0	NA	677,995
7	L43-G17-PT		365	NA	NA	NA	677,995
8	L43-G17-PL		365	4,322	NA	NA	682,317
9	L43-G17-WTP		365	NA	0	NA	677,995
10	L43-W17-PT	302,775	0	NA	NA	168	302,943
11	L43-W17-PL		0	9,086	NA	168	308,395
No Action	L60	None	NA	NA	NA	NA	NA

4.8.3 Wildlife

The Proposed Project and alternatives carried forward for further evaluation would have direct, indirect, permanent, and temporary impacts to wildlife. Chapter 3 provides descriptions of wildlife resources in the affected areas that are discussed below. Conversion of upland deciduous forest to open waterbodies within both the Glades Reservoir and White Creek Reservoir footprints would result in the loss and long-term alteration of existing habitat types, creating direct and permanent impacts to terrestrial and aquatic species. The reservoir would create new habitat types and would allow for a change in wildlife utilizing the area. The reservoir would result in an increase in biological resources available for a wide variety of wildlife species, including waterfowl and lentic aquatic species.

The river and reservoir transmission systems also would permanently alter habitat types. However, the ROW would result in a row crop/pasture habitat type similar to other power, water, and wastewater transmission ROWs which are inhabited by a variety of terrestrial and aquatic wildlife. Construction of new roads and pump stations would be considered a permanent loss of wildlife habitat. Wildlife would also be indirectly affected by the construction activities and changes to the noise or visual surroundings. These indirect impacts would be temporary, as some species will repopulate an area after it has been stabilized and revegetated.

Glades Reservoir Alternatives

Construction of the Glades Reservoir footprint and dam would affect approximately 1,002 acres of existing habitat. Approximately 24 acres of habitat loss would occur as a result of road construction and an additional 36 acres would be converted to a maintained row crop/pasture habitat type for the river and reservoir water transmission main corridors.

White Creek Reservoir Alternatives

Construction of the White Creek Reservoir footprint and dam would affect approximately 656 acres of existing habitat; however, Webster Lake is an existing open water system that would be enlarged by flooding of the surrounding areas. Since there would be an increase to available biological resources, the 20-acre Webster Lake's would not be considered an affected wildlife habitat and no wildlife species would be negatively affected. Approximately 14 acres of habitat loss would occur as a result of road construction and an additional 39 acres would be converted to a maintained row crop/pasture habitat type for the water transmission main corridors.

4.8.3.1 Terrestrial Species

Mammals

Direct effects to the small and large mammals in the Piedmont ecoregion would be similar for the proposed and action alternatives. The conversion of an upland deciduous forest to an open water reservoir would create a shift in habitat for the mammals currently in the region. Mammals such as the eastern gray squirrel (*Sciurus carolinensis*), eastern fox squirrel (*Sciurus niger*), and the eastern chipmunk (*Tamias striatus*) would be negatively affected by the conversion and would experience permanent habitat loss. However, a change in the habitat might allow for mammals such as the swamp rabbit (*Sylvilagus aquaticus*), beaver (*Castor canadensis*), mink (*Neovison vison*), muskrat (*Ondatra zibethicus*), and the river otter to utilize this new shift and thrive under new conditions.

During construction, mammal species might be indirectly and temporarily affected by noise pollution, an increase in noise disturbance, and habitat displacement. Noise disturbances may cause some species to temporarily be displaced. However, these conditions are not permanent, as some mammal species will repopulate the area after construction effects subside.

Although construction conditions are temporary, the proposed road relocations create potential barriers to wildlife movement. The new roads may cause mammal species to experience habitat fragmentation and a decrease in individual home ranges. Construction of the roadway would also result in an increase in stress in mammal species due to an increase in noise, visual disturbances, and human presence. An increase in road kill is also a potential possibility, depending on the volume of traffic in the area. Additionally, an increase in human disturbance might directly impact big game such as the white-tailed deer.

In both the Proposed Project and the alternatives, water transmission systems will need to be constructed. Although mammal species will incur temporary habitat displacement due to construction, some mammals will be able to repopulate the area after it has been revegetated. Additionally, there is

the possibility that construction will cause death of small mammals; however, work will be stopped in order to avoid possible death or injury if mammals are noted in the construction zone.

Sensitive Terrestrial Species

The affected area for the Proposed Project and its alternatives are within the potential summer range of the federally endangered species Indiana bat (*Myotis sodalis*) and the federally threatened species northern long-eared bat (*Myotis septentrionalis*).

For the Indiana bat, there is no recorded occurrence in Hall or White Counties (**Figure 4.73**), but the northern long-eared bat has been captured in both counties (**Figure 4.74**)

The U. S. Fish and Wildlife Service (USFWS) has established an interim rule under the authority of section 4(d) of the Endangered Species Act (ESA) that provides measures that are necessary and advisable to provide for the conservation of the northern long-eared bat. In particular, in areas of the northern long-eared bat's range that have not yet been affected by white-nose syndrome, as defined in the interim rule, incidental take by any means is not prohibited. In areas of the bat's range that may be affected by white-nose syndrome, it is the USFWS's opinion that incidental take caused by some tree removal and tree-clearing activities, when combined with conservation measures that protect the bat's most vulnerable life stages, does not need to be prohibited to conserve the northern long-eared bat.

Although the introduction of white-nose syndrome is the major factor to the loss of both Indiana and northern long-eared bats, loss of habitat is a secondary contributor. The flooding of the Glades Reservoir and the White Creek Reservoir would convert potential habitat for both bat species. In order to assess suitable habitat, a desktop review of potential habitat types was performed. Areas with elevations between 280 and 700 meters, south facing slopes, and forest land cover classifications were selected using a digital elevation model from the USGS and land cover data from the National Land Cover Database (NLCD), areas with elevations between 280 and 700 meters, south facing slopes, and forest land cover classifications were selected. Next, these results were compared to 2015 aerial imagery. Areas that appeared to falsely overlay forests - either due to changes in land use since 2011 or misplacement of forestland cover from the NLCD data - were then removed. Approximately 1,000 acres was reviewed for the Glades Reservoir footprint (**Figure 4.75**) and approximately 650 acres for the White Creek Reservoir footprint (**Figure 4.76**). Of the 1,000 acres within the Glades Reservoir review area, approximately 330 acres (33%) contained potential Indiana and northern long-eared bat habitat. Approximately 135 (21%) acres of the White Creek reservoir footprint contains potential Indiana and northern long-eared bat habitat.

Baseline acoustic and mist net surveys were conducted for the Glades Reservoir footprint in June, 2015 within potential habitat areas for Indiana and northern long-eared bats. Additional follow-up surveys would be conducted near the start of construction and compared to the June, 2015 findings to confirm the presence or absence of protected bats at that time. As of this writing (October, 2015), USFWS and the DNR are still analyzing mitigative measures for habitat impacts. The Applicant will be required to consult with USFWS prior to the start of construction and approved mitigation will be enacted at that time.

Figure 4.73 Locations of Indiana Bats in Georgia

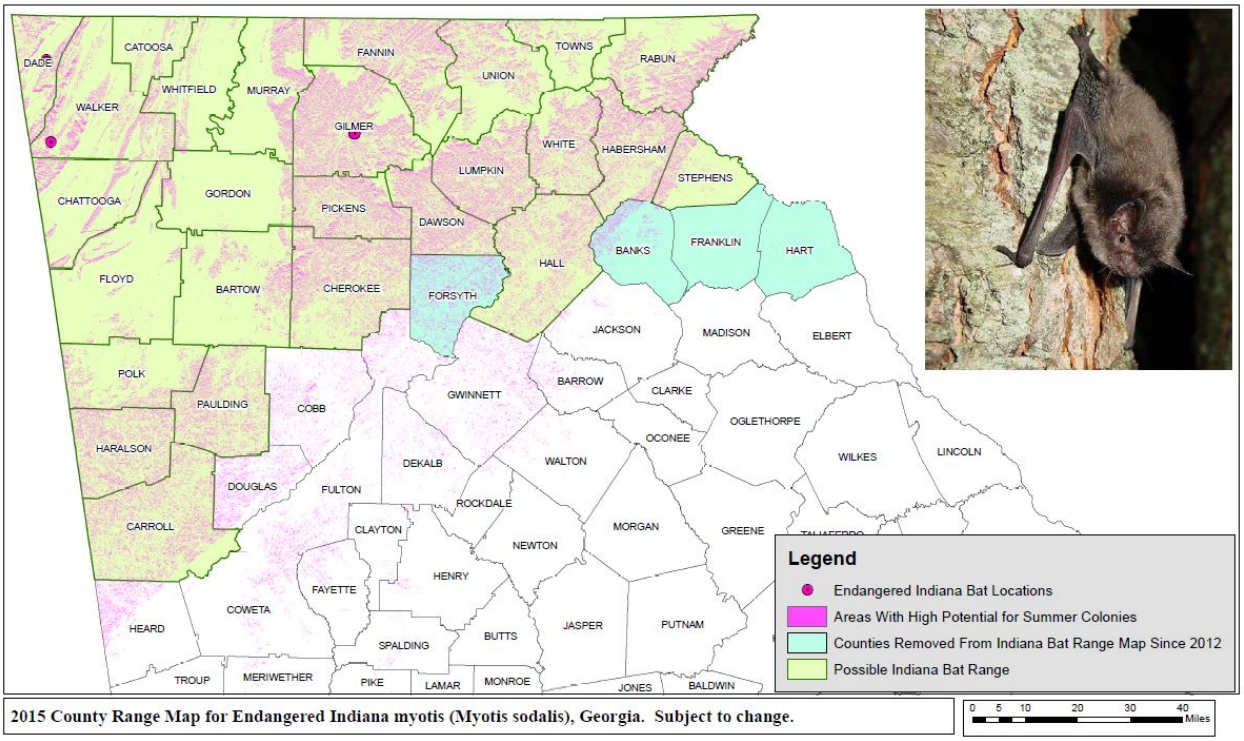
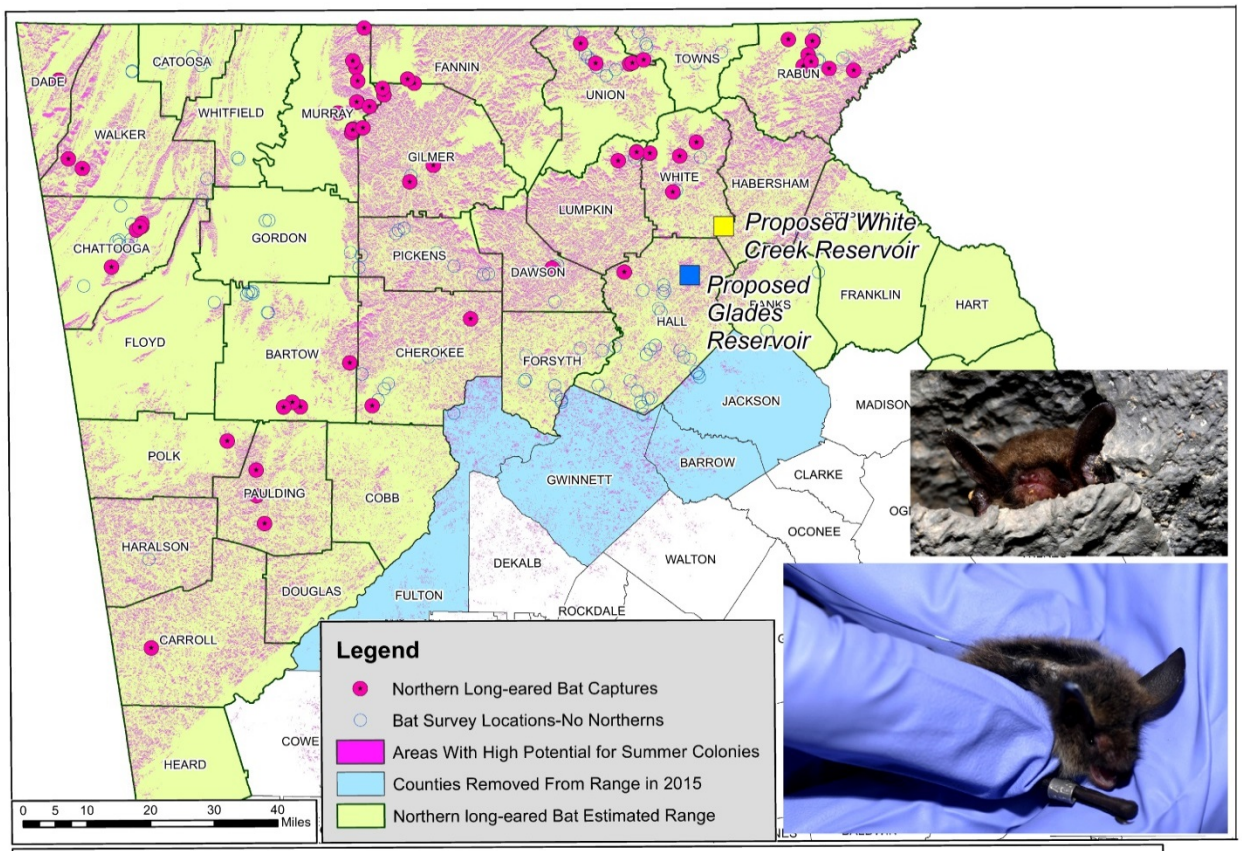


Figure 4.74 Locations of Northern Long-Eared Bats in Georgia



2015 County Range Map for Northern long-eared myotis *(Myotis septentrionalis)*, Georgia. Subject to change.

Figure 4.75 Glades Reservoir Potential Bat Habitat

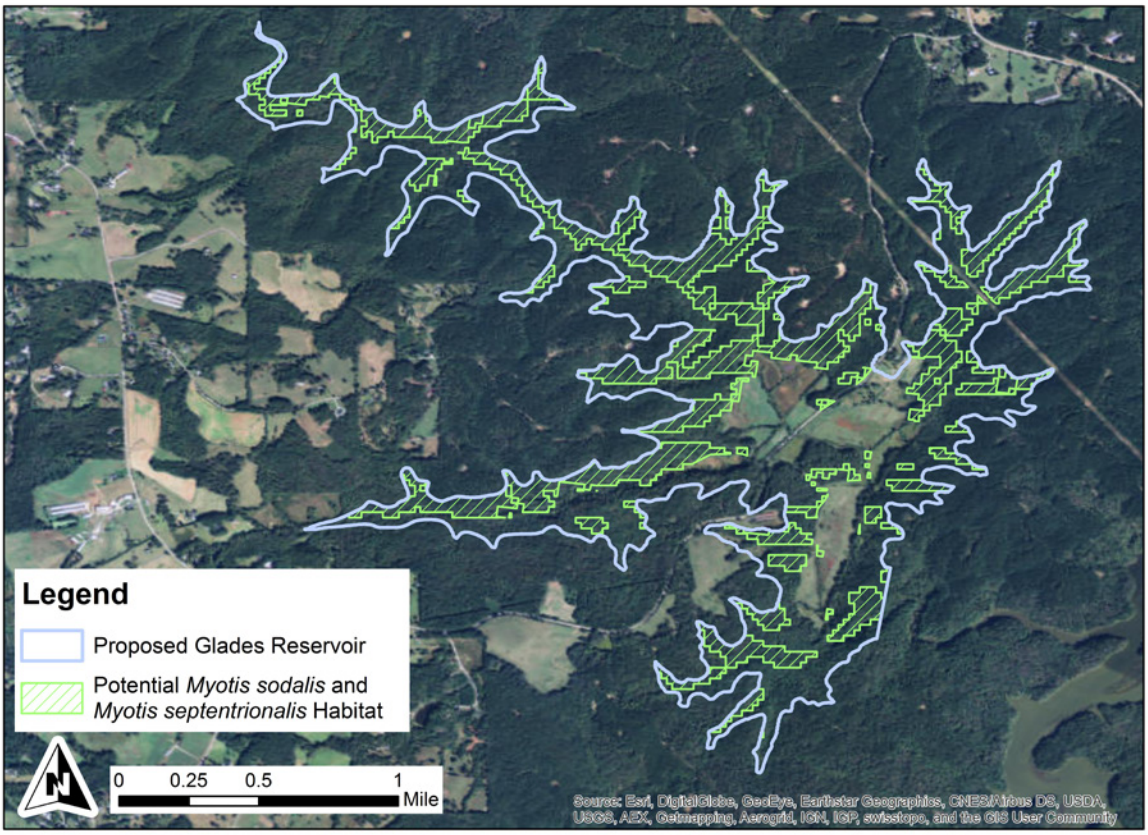
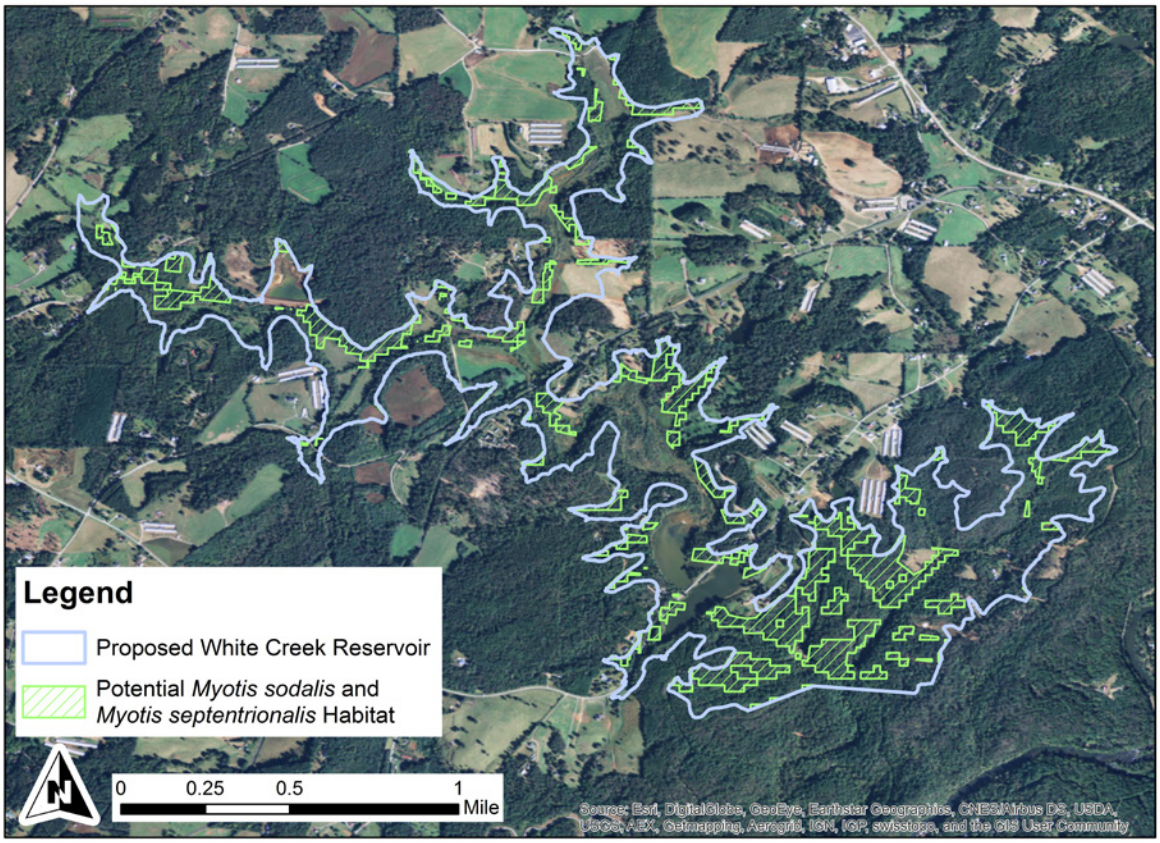


Figure 4.76 White Creek Reservoir Potential Bat Habitat



Birds

The affected area supports diverse birds of the Piedmont region from seasonal to year-round species. Flooding of the reservoirs will have direct effects on bird species in the Piedmont region. During construction, some species may be temporarily displaced due to noise disturbances and human interference. After construction, species will be able to repopulate the area after it has been revegetated. Birds such as the red-bellied woodpecker (*Melanerpes carolinus*), pileated woodpecker (*Dryocopus pileatus*), eastern screech owl (*Megascops asio*), and the barred owl (*Strix varia*) may experience a loss in habitat due to the elimination of the deciduous forest, while other species may benefit from the addition of a reservoir.

Wading birds are common in wetland areas and other aquatic habitats. The Proposed Project and alternatives would positively affect the wading birds in the Piedmont region due to an increased area of habitat. Specific wading birds to the Piedmont region include the great blue heron (*Ardea herodias*), wood duck (*Aix sponsa*), and the great egret (*Ardea alba*). During the summer season, the region is also inhabited by species such as the little blue heron (*Egretta caerulea*) and the cattle egret (*Bubulcus ibis*). Under these new conditions, these species have the potential to thrive.

The conversion of habitat from deciduous forest to an open water reservoir will also lead to an increase in food source for birds such as swallows and swifts that feed on insects over open water. Raptors such

as the osprey (*Pandion haliaetus*) and the bald eagle (*Haliaeetus leucocephalus*) that feed on aquatic life will also benefit from the construction of the reservoir.

Sensitive Bird Species

Migratory Birds

Executive Order 13186 (January, 2001) requires agencies to consider the effects of actions and plans on migratory birds. Suitable habitat for 14 migratory birds has been identified by USFWS for Hall County, including the proposed Glades Reservoir alternatives. Suitable habitat for 16 migratory bird species has been identified for White County, including the proposed White Creek Reservoir alternatives. A portion of the White Creek Reservoir transmission system corridor is located within Habersham County, which has the potential to impact habitat for 13 migratory bird species identified in Habersham County. **Table 4.60** lists all identified migratory bird species within these counties and reservoir alternatives.

Table 4.60 Migratory Bird Species

Common Name	Scientific Name	Counties	Reservoir Alternatives
American bittern	*Botaurus lentiginosus*	Hall	All Glades Reservoir Alternatives
Bald eagle	*Haliaeetus leucocephalus*	Habersham, Hall, White	All Alternatives
Blue-winged warbler	*Vermivora pinus*	Habersham, Hall, White	All Alternatives
Brown-headed nuthatch	*Sitta pusilla*	Habersham, Hall, White	All Alternatives
Canada warbler	*Wilsonia canadensis*	Habersham, White	All White Creek Reservoir Alternatives
Chuck-will's-widow	*Caprimulgus carolinensis*	Habersham, Hall, White	All Alternatives
Fox sparrow	*Passerella iliaca*	Habersham, Hall, White	All Alternatives
Kentucky warbler	*Oporonis formosus*	Habersham, Hall, White	All Alternatives
Loggerhead shrike	*Lanius ludovicianus*	Habersham, Hall, White	All Alternatives
Louisiana waterthrush	*Parkesia motacilla*	Habersham, White	All White Creek Reservoir Alternatives
Peregrine falcon	*Falco peregrinus*	Habersham, White	All White Creek Reservoir Alternatives
Prairie warbler	*Dendroica discolor*	Habersham, Hall, White	All Alternatives
Prothonotary warbler	*Protonotaria citrea*	Hall	All Glades Reservoir Alternatives
Red-headed woodpecker	*Melanerpes erythrocephalus*	Habersham, Hall, White	All Alternatives
Rusty blackbird	*Euphagus carolinus*	Habersham, Hall, White	All Alternatives
Swainson's warbler	*Limnothlypis swainsonii*	Habersham, White	All White Creek Reservoir Alternatives
Wood thrush	*Hylocichla mustelina*	Habersham, Hall, White	All Alternatives
Worm eating warbler	*Helmitheros vermivoum*	Habersham, Hall, White	All Alternatives

Osprey and Eagles

Although no bald eagle nests were identified during the 2002 field survey, GDNR records indicate one eagle nest was identified approximately 2.5 miles south of the reservoir footprint. Both the proposed Glades Reservoir and the White Creek Reservoir would provide additional breeding and foraging habitats for eagles, as well as ospreys that might be in the area.

Amphibians and Reptiles

The richest biodiversity of amphibians and reptiles is found in the southeastern United States, and Georgia has a high abundance of amphibians and reptiles. Snakes, turtles, lizards, frogs, toads, and salamanders can all be found within the potential reservoir site. These species are found in a wide variety of habitats and would be affected differently by the proposed construction activities. In general, less mobile amphibians and reptiles could be killed by construction equipment. The more mobile species would be at least temporarily displaced.

A large number of snake species can be found within the proposed boundaries of both reservoirs. Most of the snakes found in the area would be negatively affected by dam and reservoir construction. Large-scale inundation would destroy all preferred habitat for non-aquatic snakes, including forests, scrublands, and open fields. The constructed reservoir would provide marginal habitat for water snakes along the edges, but the aggregate amount of suitable habitat for snakes would be reduced.

Habitat for both aquatic and terrestrial turtles can be found in the proposed reservoir zones. The construction of the dam and reservoir affects terrestrial turtles by inundating large portions of suitable upland habitat; aquatic turtles would be affected to a lesser degree. Although open expanses of water generally are not prime terrestrial turtle habitat, the proposed reservoir would provide some habitat around the waterbody's edges.

Habitat for frogs and salamanders exists in wetlands and streams within the proposed reservoir zones. Some of these habitat types would disappear due to flooding and the quality of some habitats would be altered by the proposed water transmission systems. Stream crossings created by the construction of water transmission systems would remove dominant shading plant species, negatively impacting salamander and frog habitat. Potential sedimentation from bank destabilization would impact substrates and potentially alter the preferred habitat of numerous species that require deeper stream channels. Additionally, construction of access roads would result in culverted road crossings that could alter a small portion of stream substrates and potentially alter stream flow velocities within the water transmission system ROWs. Culverted road crossings would potentially impact frogs and salamanders by removing habitat in the piped sections if the culvert is not designed for the passage of wildlife. Culvert designs and wildlife utilization are discussed in more detail in the Aquatic Species section below.

Mitigation and Monitoring for Terrestrial Species

Although individual terrestrial animals will be permanently displaced within the reservoir footprint by the flooding of upland habitats, it is anticipated that mobile species will relocate to the surrounding areas that contain similar habitat types. Construction activities and the flooding of the reservoir would likely result in the death of less mobile terrestrial species; however, this loss of individual animals would not result in a decrease in the overall population of a particular species. Avoidance and minimization of sensitive species habitats will occur where practicable; in cases where avoidance is not possible, approved mitigative measures would be implemented.

Currently, the project proposed to avoid impacts to nesting bats by restricting tree clearing of moderate to high quality habitat to the winter months of mid-October to the end of March. Implementation and maintenance of proper erosion and sedimentation controls would ensure additional protection of streams that would be used as foraging habitat for bat species.

Conversion from streams to still water systems would result in a change in habitat for 94,121 linear feet of streams for the Glades Reservoir and 59,698 linear feet of streams for the White Creek Reservoir.

4.8.3.2 Aquatic Species

This section discusses the effects of the proposed and action alternatives on aquatic species and their aquatic biological resources. Biological resources for aquatic species include preferred foraging, breeding, and nesting habitats, as well as preferred water quality and flow regimes. Potential effects include both positive and negative direct effects to aquatic species. Construction of the reservoir's dam, flooding of streams within the reservoir footprint, rerouting and construction of new roads, and the construction of water transmission pipelines would result in direct impacts to aquatic species.

The effects to aquatic biological resources common to all of the action alternatives would be due primarily to changes in hydrology associated with the reservoir footprint, as well as reduced flows in the Chattahoochee River during periods of low flow. Within the pool of Lake Lanier and downstream of the lake, no appreciable changes are anticipated to lake levels or flows resulting from construction of the Proposed Project and its alternatives, as discussed in Section 4.3.2. Given that no appreciable pool changes are anticipated in Lake Lanier and no appreciable flow changes are anticipated downstream of the lake, there are no anticipated impacts to habitat within or downstream of Lake Lanier.

Inundation of a reservoir footprint would alter biological resources, potentially resulting in an increase in quantity of some aquatic species and a decline in population for other aquatic species. Conversion of a flowing water system (lotic) to a still water system (lentic) - such as a reservoir - would also alter the biological resources. Aquatic species inhabiting the flowing streams within the Glades Reservoir or the White Creek Reservoir footprints would no longer encounter their preferred habitat requirements and would be negatively impacted by the loss of multiple habitat conditions. However, both the Glades Reservoir and White Creek Reservoir alternatives contain existing lentic ecosystems; therefore, established populations preferring relatively still water currently exists. The existing lentic populations would be positively impacted by an increase in preferred habitat.

In addition to altering habitat, the construction of a reservoir would create an impassable dam structure and a still water barricade that lotic species would potentially avoid, resulting in isolated populations of lotic species. Both Flat Creek and White Creek currently have existing barricades and resulting aquatic population isolations. Below Georgia Highway 52, Flat Creek flows over a long steep rock outcrop (Glade Shoals) that currently serves as a barrier to upstream fish migration (Straight, et.al, 2003). Webster Lake and the existing dam structure also serve as a barrier to upstream fish migration. Mussel species and lotic fish populations located upstream of Glade Shoals and Webster Lake are currently isolated from downstream populations identified within Flat Creek and White Creek; therefore, these larger stream

systems would not be further impacted by population isolation (**Figure 4.77**). However, species inhabiting the smaller streams flowing into Flat Creek and White Creek would experience population isolation as a result of reservoir construction.

Figure 4.77 Glades Shoals and Webster Lake

Macroinvertebrates

Macroinvertebrates inhabit all types of running waters, from fast flowing mountain streams to slow-moving muddy rivers. Examples of aquatic macroinvertebrates include insects in their larval or nymph form, crayfish, clams, snails, and worms.

Stream crossings created by the construction of the river water and reservoir water transmission systems would impact aquatic macroinvertebrate habitat by removing shading plant species and potentially raising water temperatures. Potential sedimentation from bank destabilization would impact substrates and food sources preferred by aquatic macroinvertebrates.

Additionally, construction of access roads would result in culverted road crossings that would remove a small portion of stream substrates and potentially alter stream flow velocities within the water transmission system ROWs. These negative impacts associated with the access roads and water transmission system ROWs are common to all reservoir alternatives, they are relatively minor in size. The water transmission ROWs are anticipated to be a maximum with of 30 feet and each road crossing is anticipated to be approximately 15 linear feet located within the 30 foot ROW.

Freshwater Mollusks

Similar to macroinvertebrates discussed above, freshwater mollusks (mussels) inhabit water flow regimes ranging from lentic to lotic and have preferred habitat conditions based on different water flow regimes. Most female freshwater mussels reproduce by releasing larvae (glochidia) onto the gills and fins of suitable fish hosts. Therefore, the mussel is also dependent on the habitat variables that are preferred by the mussel's fish host. Mussels (and their respective fish host) preferring a flowing water system (lotic) would be negatively impacted by the flooding of the streams within both the Glades Reservoir and White Creek Reservoir footprints. The Glades Reservoir footprint encompasses a historic lake feature (Glades Lake) that may have created isolated/fragmented population of mussels upstream of the historic lake. The White Creek Reservoir footprint encompasses Webster Lake, which is an active and maintained still water system. This lake also may have fragmented lotic mussel species within the flowing streams above Webster Lake (**Figure 4.77**).

One mussel species, the eastern floater (*Pyganodon cataracta*), was observed near the proposed dam location within the Glades Reservoir footprint during the 2002 Flat Creek Protected Species Survey (Straight, 2003). This mussel and its fish host, the common carp (*Cyprinus carpio*) are both likely to occur in larger slower moving waters including creeks, rivers, lakes, and reservoirs. Due to the presence of the gizzard shad (*Dorosoma cepedianum*), common carp, and eastern floater mussel within Flat Creek, the Applicant's Proposed Project would have a positive impact on mussel species that have been identified within the Glades Reservoir footprint.

Similar to the Glades Reservoir, the White Creek Reservoir footprint would encompass an existing lentic ecosystem. Although no protected species or presence/absence survey for mussel species is known for the White Creek Reservoir footprint, lentic mussel species may also be present at this location. Mussel

species dependent on lentic flow regimes would be positively impacted by the construction of the White Creek Reservoir, while lotic species would be negatively impacted.

Impacts associated with the River Water and Reservoir Water Transmission Systems

Stream crossings created by the construction of the river water and reservoir water transmission systems would negatively impact mussel habitat by removing shading plant species and potentially raising water temperatures. Potential sedimentation from bank destabilization would impact substrates and potentially alter the accessibility of fish hosts. Additionally, construction of access roads would result in culverted road crossings that could alter a small portion of stream substrates and potentially alter stream flow velocities within the water transmission system ROWs. Perennial streams crossed by culverts would be required to account for fish passage by being embedded by at least 30%. Although unlikely and depending on the substrates used for the culvert embedding, as well as the amount of native substrate that migrates into the culvert, mussel species may inhabit the substrates within the culvert crossings. These negative impacts associated with the water transmission system ROWs are common to all reservoir alternatives, but are relatively minor in size. The ROWs are anticipated to be a maximum width of 30 feet and each road crossing is anticipated to be approximately 15 linear feet located within the 30-foot ROW.

Impacts to Lake Lanier and the Chattahoochee River below Buford Dam.

As discussed in Chapter 4 (Water Resources Management and Use), when compared to the No Action Alternative, the action alternatives would have negligible impacts to the water surface levels at any of the Corps projects, including Lake Lanier. The greatest anticipated pool difference at Lake Lanier is a lake level increase of less than 0.5-inch (with Glades) over the No Action (without Glades) alternative.

Additionally, water surface levels at Lake Lanier and other downstream reservoirs would continue to be maintained by the Corps in a balanced manner based on the current Water Control Manual. Changes in streamflows in the Chattahoochee River above Lake Lanier as a result of any action alternatives would be accounted for in the Corps' operation of the ACF system; the Corps would maintain optimal lake levels in all projects according to its current Water Control Manual. As discussed in Chapter 4, Impacts to Streamflow, there would be no discernible changes to flow south of the Buford node when comparing the action alternatives to the No Action Alternative. Therefore, there would be little to no change to mussel species habitats either in Lake Lanier or in the Chattahoochee River downstream of Buford Dam.

In summary, the streamflow alternation in the Upper Chattahoochee River is not likely to adversely affect mussel species habitat within Lake Lanier or in the Chattahoochee River below Buford Dam.

Crayfish

Similar to the mussels discussed above, crayfish inhabit similar water flow regimes from lentic to lotic habitats that include streams, lakes, marshes, roadside ditches, cave systems, and even burrows. Although crayfish can survive in extreme temperatures, they prefer cooler areas. A potential increase in water temperature due to the removal of shade plants could cause disruption to the crayfish environment. Displacement of rocks and vegetation during the development of the reservoir may also negatively affect the species in the Proposed Project and alternative areas.

In the northern region of Georgia, most crayfish species inhabit streams. There are seventy crayfish species found in Georgia and fifteen of these are found within the Chattahoochee River System.

The Chattahoochee crayfish (Cambarus howardi) is classified by the state as a threatened species, is a protected species that potentially exists in the area. Stream sedimentation is a potential product of construction that may cause a loss of habitat. Impoundment could also have negative effects to the crayfish populations and has been identified previously as a threat.

Fish

All perennial streams potentially impacted by any of the reservoir alternatives are warm water streams unsuitable for supporting stocked or natural trout populations. None of the streams within any of the alternatives are listed as High Priority Waters, nor do they contain High Priority aquatic species. The portions of the Chattahoochee River potentially affected by the reservoir alternatives, as well as the confluences of respective perennial streams, are regarded as popular recreational fishing areas (discussed in Section 4.8.3 Recreation) and contain the following sustainable populations:

- Striped bass (*Morone saxatilis*)
- Walleye (*Sander vitreus*)
- Crappie (*Pomoxis* sp.)
- Catfish (*Ictalurus* sp.)
- Longnose gar (*Lepisosteus osseus*)
- Shoal bass (*Micropterus cataractae*)
- Largemouth bass (*Micropterus salmoides*)
- Redeye bass (Micropterus coosae)
- Spotted bass (*Micropterus punctulatus*)
- White bass (*Morone chrysops*)
- Redbreast sunfish (Lepomis auritus)
- Bluegill (*Lepomis macrochirus*)

Additionally, the Protected Species Survey for Flat Creek, Hall County, Georgia (Straight et. al, 2003) identified 22 species within Flat Creek and its major tributaries, including yellowfin shiner (*Notropis lutipinnis*), bluefin stonerollers (*Campostoma pauciradii*), and spottail shinners (*Notropis hudsonius*). These species may also inhabit similar streams located within the White Creek and its major tributaries. Aquatic species surveys would be performed prior to the start of construction if any of the White Creek alternatives are chosen. Species identified within the Flat Creek or White Creek watershed would be affected by activities associated with construction, clearing, and reservoir flooding.

4.8.3.3 Impacts to Aquatic Species

Impacts within the Reservoir Footprints

Conversion from streams to still water systems would result in a change in habitat for 94,121 linear feet of streams within the Glades Reservoir footprint and 57,837 linear feet of streams within the White Creek Reservoir footprint. Although some lotic species would be displaced, the reservoir would likely be

stocked for recreational fishing; therefore, species such as largemouth bass, crappie, redbreast sunfish, and bluegill would benefit from the construction of a reservoir. Construction activities along streambanks may cause mortality of some individual fish; some nongame species would relocate to flowing streams located upstream of the reservoir footprint. Lentic species inhabiting the lower reaches of Flat Creek or White Creek near the dam location would potentially be trapped during the filling of the reservoir, resulting in a loss of habitat and potential mortality. Although construction of either reservoir creates a potential for the death of individual fish, there are no fish species currently identified within either reservoir footprint that would be affected to such a degree as to threaten the overall population of that species.

Impacts Downstream of the Reservoir to the Chattahoochee River

In the pass-through alternatives, the required water supply quantity is released below the proposed dam via Flat or White Creek to the Chattahoochee River and eventually into Lake Lanier. This process would raise the existing flows of Flat Creek or White Creek from the dam location downstream to the Chattahoochee River. Increases to flow rates below the proposed reservoir dam will alter the existing aquatic species habitat. Stream flows fluctuate between 0.4 to 1,719 cfs for Flat Creek and 0.2 to 998 cfs for White Creek, respectively. The pass-through alternatives would result in average daily flows between 30.3 to 79.0 cfs for Flat Creek and 22.1 to 68.1 cfs for White Creek, respectively. Although there would be an increase in stream flows from the pass-through alternatives, the increased flow are well within the historical minimum and maximum daily flow ranges for both proposed reservoir locations.

Additionally, operation of the reservoir's dam has the potential to lessen the extreme peaks and valleys that may be observed in flood and drought conditions (**Figure 4.18**). As discussed in Section 4.2.4, two general rules apply for reservoir operation: (1) the IFPT or the natural streamflow into the reservoir would be maintained below the dam, whichever is less, and (2) when the reservoir water level is greater than the maximum pool elevation for the proposed reservoir, the water will be spilled into the tributary. Reduced flood and drought potential would provide stable habitats and increased populations of aquatic species.

The Glades Reservoir pass-through alternatives would release additional flow into Flat Creek, which is also impacted by the fluctuating pool levels of Lake Lanier. This additional flow would provide a slight increase in available habitat for fish and other aquatic species when Lake Lanier is experiencing lower pool elevations. Most of the time, an increase in flow below the dam in Flat Creek would be absorbed by Lake Lanier's backwater influence. Additional flow added to the reach already affected by Lake Lanier would potentially increase habitat for both lentic and lotic species types. White Creek is not under Lake Lanier's influence; therefore, the additional stream flows generated by the pass-through alternatives result in a slight increase in available habitat and have beneficial effects to aquatic species within White Creek.

The Proposed Project and seven alternatives (2, 3, 5, 6, 8, 9, and 11) do not utilize a pass-through process and would transport the reservoir water to a WTP via a system of underground piping. Piping the reservoir water would redirect flows from the normal stream path to the pipe system, thereby

reducing the flow within Flat Creek or White Creek downstream of the respective dam locations. Although the piping alternatives would lower the flows within Flat Creek or White Creek, the reduced flows are also within the historical minimum and maximum flow ranges; as such, adverse impacts to aquatic species would not be anticipated. White Creek is not affected by Lake Lanier's maintained pool level; therefore, the portion of White Creek below the proposed dam location would experience less water and a loss of habitat for fish species.

Impacts within the Chattahoochee River

Field studies were utilized in conjunction with the USGS PHABSIM to analyze potential impacts to fish communities due to withdrawal of water from the Chattahoochee River. The PHABSIM modeling simulates a relationship between streamflow and physical habitat for various life stages of a species of fish or a recreational activity. The basic objective of the simulation is to obtain a representation of the physical stream so that the stream may be linked, through biological considerations, to the social, political, and economic world. Details of the field studies and PHABSIM modeling are discussed further in **Appendix O**.

A primary concern to the WRD is that impacts to the spawning behavior of the transient migratory game fish species could affect their availability to anglers.

As part of the Applicant's Water Withdrawal Permit Application submitted to Georgia EPD in 2011, a fish survey, stream flow analysis, and PHABSIM modeling were included in *Study of Flow Impacts on the Fish Community in the Chattahoochee River Downstream of Proposed Water Intake* (December 2010, CCR Environmental, Inc.). At the request of GDNR's WRD, additional field studies and PHABSIM modeling were performed to assess the following:

- potential impacts to fisheries under additional flow scenarios (including annual and monthly 7Q10)
- impacts to game fish species (including spawning species that migrate upstream into the Chattahoochee River from Lake Lanier)
- impacts to recreational boaters (which will be discussed further in Section 4.8.3 Recreation)

Additional fish survey data from the *Study of Bio/Physical Characteristics of Flat Creek* (Dinkins, 2006), *Protected Species Survey for Flat Creek* (Straight, Hagler, and Freeman, 2003), and WRD's annual electrofishing surveys performed in the Chattahoochee River between Lake Lanier and Bull Shoals (2008 to 2012) were used to assess fisheries and habitats. Four new cross-sectional profile transects, additional substrate/habitat surveys, and further evaluation of shallow, low-flow choke points were used for calculating additional PHABSIM modeling.

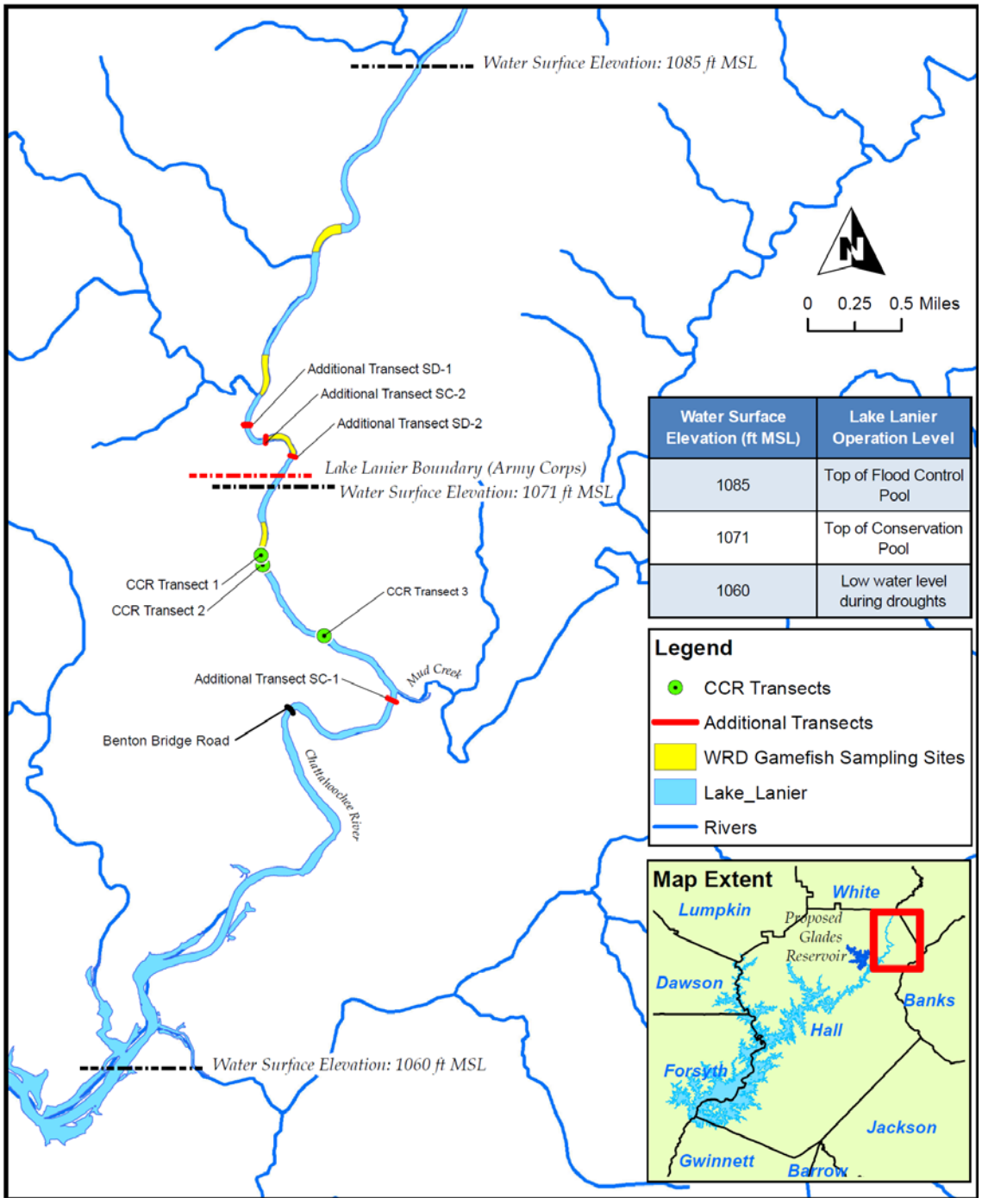
A range of flow conditions, from 5% AADF (46 cfs) to the March average monthly flow (1,388 cfs), were evaluated, including spring seasonal average flow for the months of February through April. The spring months were evaluated to predict the impact on migrating game species from Lake Lanier during the period the species are most likely to migrate for spawning purposes.

Simulations were run to predict the critical flow scenario (or the stream depth of key shallow choke points in the river) that may prevent the spawning game fish from migrating upstream from Lake Lanier. Additionally, field studies identified various fish habitat types for resident game and nongame species within the Chattahoochee River from the proposed Intake (for Glades Reservoir) to just downstream of the Chattahoochee River's confluence with Mud Creek.

Several primary habitat types - including shallow to medium depth runs and glides, deeper pools, and shallow riffles and shoals - were identified within the Chattahoochee River. Measurements of instream cross-sectional profiles (transects) from a representative portion of the various habitat types preferred by migratory fish, year-round game fish, and year-round nongame fish species were taken. The PHABSIM models simulate hydrologic conditions estimated from transects established on two shoals, one shallow run, and also two slow-deep and two shallow-choke habitat types (the transects were measured by both Hall County and the DEIS team). The results of the PHABSIM models are displayed in three general habitat types:

1. Shallow/Fast (Riffles and Shoals) – consists of the two shoals and shallow-choke transects
2. Deep/Fast (Runs) – consists of the shallow run transect
3. Deep/Slow (Pools) – consists of the two slow-deep transects

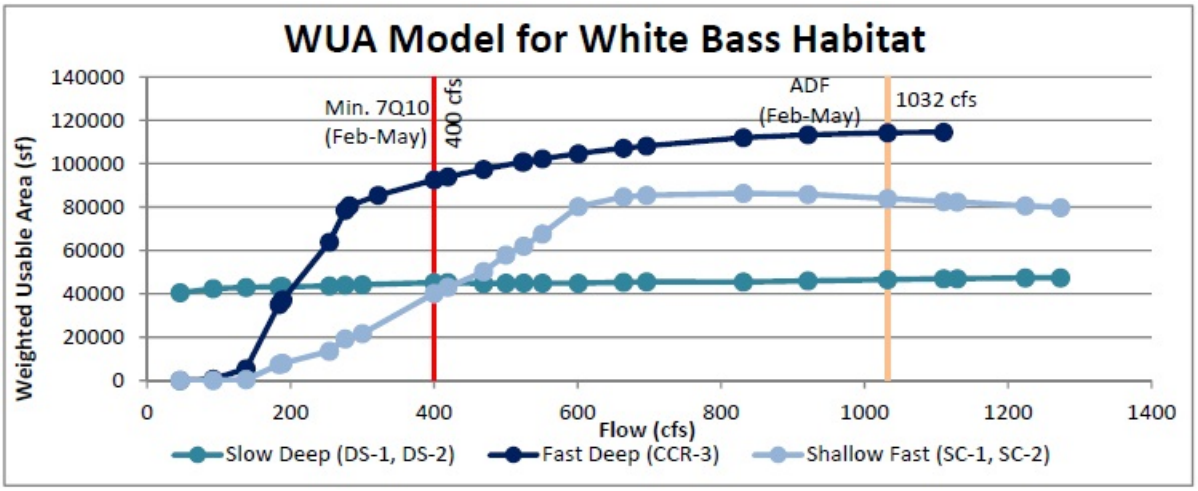
Figure 4.78 Fish Survey and Transect Locations in the Chattahoochee River



The PHABSIM model uses a suite of variable parameters to evaluate how differing flow conditions observed within the various habitat types could affect fish species. PHABSIM incorporates Habitat Suitability Curves (HSCs) for various habitat parameters for each species (or guilds of species representing specific types of fish that utilize the same habitat type). The HSCs identify ranges of values for various habitat factors that are measurable and important to each species or guild. The values provide a ranking of habitat quality (generally from poor to optimal on a 0 to 10 scale) for each factor.

The model estimates the changes in flow velocity, depth, cover, and substrate area of the waterbody for hypothetical flow scenarios and predicts the resulting changes to habitat area and quality under those scenarios. The model expresses its simulation of species suitability for differing flow scenarios with a value that is called the Weighted Useable Area (WUA). **Figure 4.79** shows one example of the WUA model output (for White Bass – one of the migratory game fish analyzed). Outputs for other species evaluated are detailed in **Appendix O.** Generally higher WUA indicates higher quality habitat. The figure below shows that the shallow fast areas in the river is the critical habitat during low flow conditions and loss of habit could occur as flow decrease below approximately 150 cfs.

Figure 4.79 WUA Model for White Bass Habitat



WUA is a representative index of habitat value and area based on physical attributes of the habitat under a specific flow scenario. The transects used in the PHABSIM analysis also provided an opportunity to examine passage through shallow choke points and holding conditions in pools at different flow levels. Tables depicting WUA values for each of the three habitat types and multiple flow scenarios for resident and migratory fish species are detailed in **Appendix O**. The main criterion for successful fish passage at low flows is determined by the percent of AADF at the proposed intake site in the Chattahoochee River. Based on PHABSIM modeling, 10% AADF (92 cfs) is the minimum flow needed to meet the habitat requirements for resident game fish, nongame fish, and migratory fish species. The existing AADF is estimated to be 921 cfs based on streamflow record at the USGS gage 02331600 Chattahoochee River near Cornelia (8/21/1957 to 12/31/2012). **Figure 4.80** graphically represents the expected extremes of potential flow scenarios along the reference points. **Figure 4.81** shows the river cross section at one of the shallow choke points and the estimated water levels for range of flow scenarios evaluated, including the estimated minimum safe boating depth. For the critical point evaluated (Shallow Choke 1), the corresponding minimal safe boating depth (MSBD) and river flow is close to the value of 30% AADF (276 cfs).

Figure 4.80 Range of Flow Conditions Considered at the Glades Intake Location

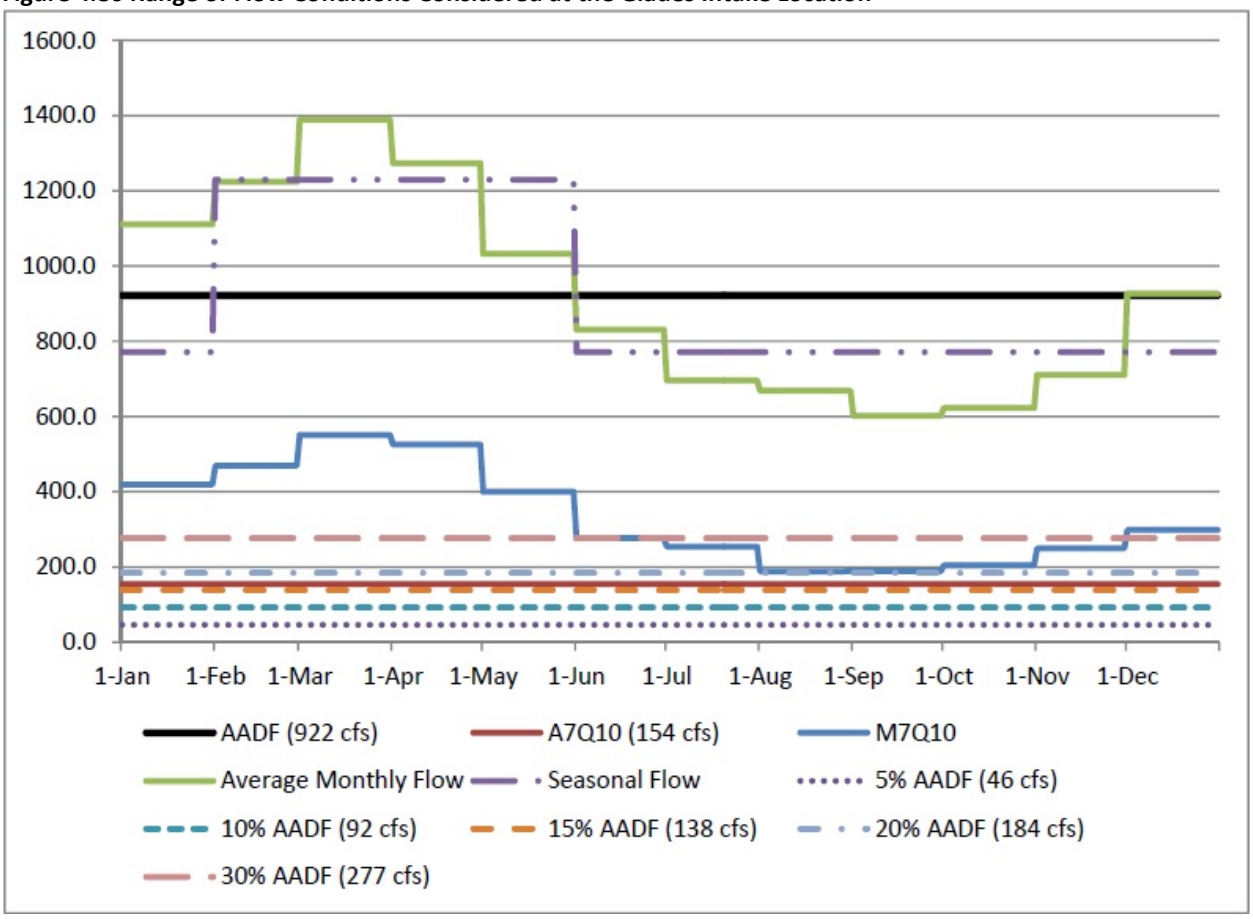
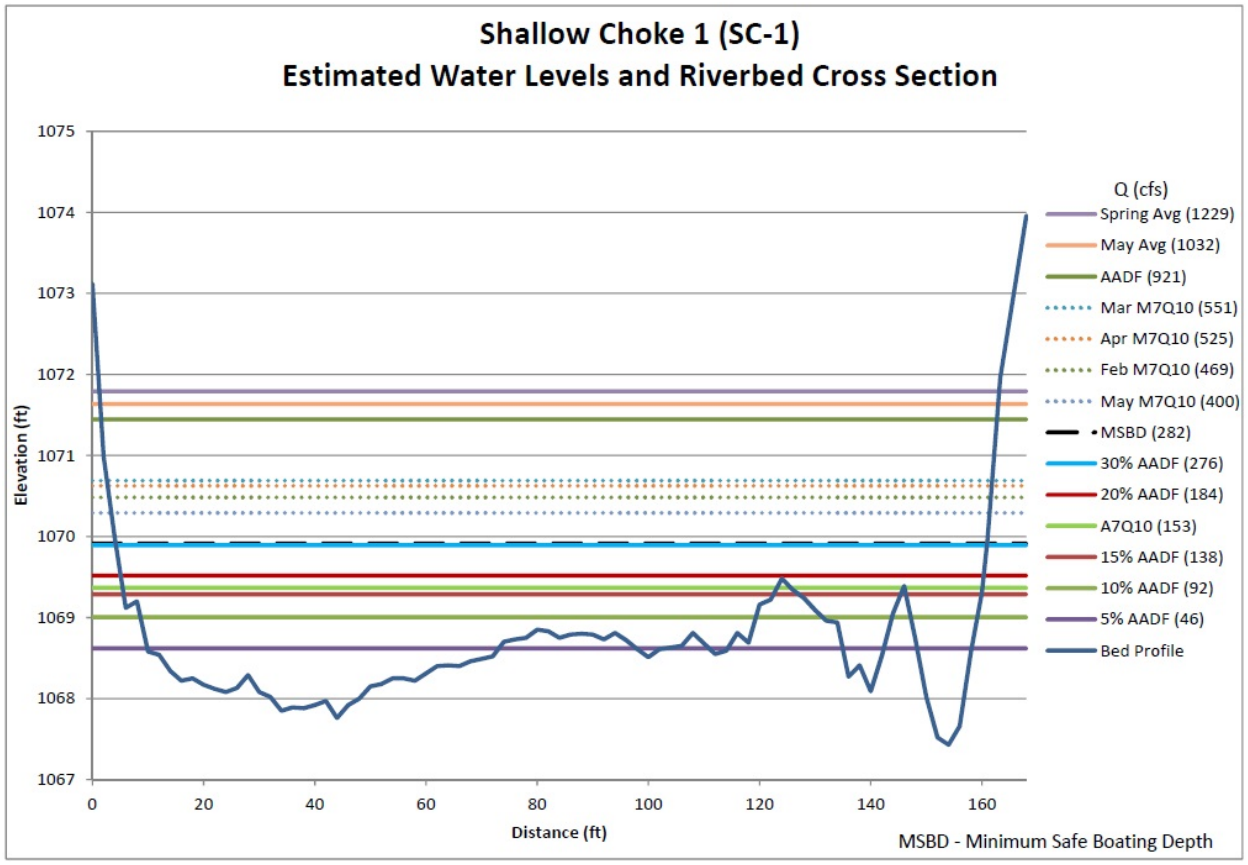


Figure 4.81 Shallow Choke 11 (SC-1)



The following conclusions are made based on the results of PHABSIM modeling:

- Year-round resident game and nongame fish species generally are predicted to experience increases in habitat quality and quantity under flow conditions as low as 10% AADF (92 cfs) level evaluated in this analysis. As flow decreases, deep habitat changes to shallow habitat that is suitable for resident fish species. Within the study area, the best estimated flow for the broadest collection of year-round resident fish (including game fish and nongame fish) is generally between 10% (92 cfs) and 30% AADF (276 cfs). At 5% AADF (46 cfs), reductions in WUA are apparent for several species, particularly those that occur in the shallow/fast riffle habitat.
- Springtime spawning flows for migrating species can safely go to the 10% AADF during the period February to April without impacting the ability for these species to migrate upstream (i.e., sufficient channel depth/width). The model indicated that for these species, the habitat suitable for spawning is lower under the lower flow scenarios and generally higher with increased flow. However, typical average daily flow during the spawning season far exceeds the lower flow scenario levels.
- Potential reduced flow conditions in the upper Chattahoochee River are not expected to cause a loss of productivity (recruitment) for transient striped bass, walleyes, or white bass; existing river conditions do not support successful hatching of eggs/development of larvae for these species.

- The 10% AADF (92 cfs) flow scenario generally appears to meet the habitat needs of the representative year-round resident fish community within the study area with only limited impacts. At 5% (46 cfs) AADF, some species are predicted to experience a reduction in habitat quality/volume.
- Transient game fish species generally experience increases in WUA with higher flows and reductions with lower flows. Flows of 30% AADF or greater (up to the highest flow scenarios considered) seem to benefit these species for the period February through May when they enter the upper Chattahoochee River from Lake Lanier. Reductions in WUA could limit the number of migratory gamefish that could be supported within the river upstream of the elevation of Lake Lanier (i.e., water surface elevation).
- The Applicant requested that A7Q10 (154 cfs) or 17% AADF be approved as the IFPT required below the proposed raw water intake in the Chattahoochee River. Based on the conclusions above, the flows below A7Q10 are sufficient to support year-round resident game and nongame fish species in habitat quality and quantity during all months of the year, including springtime spawning migration of transient game fish species. The Applicant's requested flow of A7Q10 appears to be a suitable IFPT for protection of habitat for these aquatic species.

Impacts from Reservoir Water Transmission Main Construction in the Chattahoochee River

Temporary impacts to the Chattahoochee River are anticipated, due to construction of the water transmission main connecting the reservoir to the Lakeside WTP. The maximum pipe diameter for installing a water main river crossing using horizontal direct drilling (HDD) is limited to 48 inches under most environmental constraints, such as wetlands and streams. It may be possible to apply HDD to the reservoir water transmission main; however, its size (up to 60 inches diameter), potential engineering constraints, and costs make HDD an impractical alternative.

Currently, it is anticipated that the water transmission main river crossing will be installed under the Chattahoochee riverbed via with the use of a diversion ditch and open trench cutting techniques. The pipe would be encased in concrete and a layer of rip-rap would be placed on the concrete up to the surrounding streambed. River sediments would eventually embed the rip-rap's interstitial spaces. This process would temporarily impact fish species; however, the impacts would be short-term and occur in the vicinity of the proposed river crossing location. After the pipeline is installed under the Chattahoochee River, pre-construction flows would resume across the pipeline corridor.

Impacts to Lake Lanier and the Chattahoochee River Downstream of Buford Dam

As discussed in section 4.2.3.2, when compared to the No Action Alternative, there are negligible impacts to the water surface levels at any of the Corps projects, including Lake Lanier, from any reservoir alternatives presented in the DEIS. The greatest anticipated pool difference at Lake Lanier is a less than 0.5-inch increase in pool elevation over the 'without Glades' alternative. No impacts to fish species are anticipated within Lake Lanier from such a negligible elevation change. Additionally, water surface levels of Lake Lanier would continue to be maintained by the Corps. A change in stream flows that would alter the Chattahoochee River above Lake Lanier as a result of any action alternative would be accounted for in the Corps' operation of Buford Dam. Since Corps would maintain the optimal lake

operation according to its operation manual, there would be little to no change to fish species habitats either in Lake Lanier or in the Chattahoochee River downstream of Buford Dam. As discussed in section 4.2.3.2, Impacts to Streamflow, the reservoir alternatives presented in this DEIS have no discernible changes to flow south of the Buford node when compared to the No Action Alternative.

The portion of the Chattahoochee River below Woodruff Dam contains critical habitat for the federally threatened Atlantic sturgeon (*Acipenser oxyrinchus*). Analysis of hydrological modeling results indicate that none of the action alternatives would present a discernible change in flows in the Chattahoochee River below the Woodruff Dam. Since the alternatives would have negligible impacts to the range of depths required by spawning Atlantic sturgeon, the alternatives would not likely have adverse effect on this species.

4.8.3.4 Mitigation and Monitoring

Maintaining the IFPTs within the Chattahoochee River that have been developed using the PHABSIM model is one method to preserve the stream flow targets for aquatic game species. Preserving the instream flows helps to preserve stream habitat for other wildlife and aquatic species throughout the food web.

The Applicant requested that A7Q10 (154 cfs) or 17% AADF be approved as the IFPT required below the proposed raw water intake in the Chattahoochee River. Based on the conclusions above, the flows below A7Q10 are sufficient to support year-round resident game and nongame fish species in habitat quality and quantity during all months of the year, including springtime spawning migration of transient game fish species. The Applicant's requested flow of A7Q10 appears to be a suitable IFPT for protection of habitat for these aquatic species.

Any adverse impacts to sensitive species would be mitigated for under guidance and coordination with USFWS.

4.8.3.5 Unavoidable Adverse Impacts

Unavoidable adverse impacts would occur to streams and wetlands, as outlined in **Table 4.56** and **Table 4.57**. Seasonally saturated or flooded wetlands and streams would be permanently inundated; therefore, long-term changes to WOUS would also alter biological characteristics including aquatic and semi-aquatic species, as well as any wetland or riparian corridors that provide preferred habitat for those species. Details of the PHABSIM model (**Appendix O**) provide a thorough analysis of water flow regime on game fish, which is discussed in Section 4.8.3 Recreation. As the flowing streams and wetlands are inundated and converted to a more lentic ecosystem, the biotic contributors such as bacteria, benthic invertebrates, fish, and plant species will also change from mobile species to those that prefer more stationary habitats. Potential roosting habitat for bats could also be impacted; however, studies for these species would occur at a later time.

In spite of these unavoidable adverse impacts, new habitats will be created for reservoir species, as well as potential development of fringe wetlands that may be established among the edge of the reservoir.

4.9 Socioeconomic Conditions

4.9.1 Housing, Communities, and Transportation

The impacts to housing, communities, and transportation in the vicinity of each alternative are discussed below. Construction of the water supply infrastructure components – the reservoir (including roadway relocations), the river and reservoir transmission systems, the new WTP, or expansion of the Lakeside WTPs - is not expected to occur at the same time, but in phases. The construction sequence, timeline, and phasing for each alternative are discussed in Chapter 2.

The reservoir site constitutes the majority of the discussion, since this is the area with the largest project footprint. The transmission mains would be underground and are not anticipated to disrupt communities in a permanent manner.

Each reservoir site has an associated figure that illustrates the existing structures and roadways within the affected area. Structures were identified using field data collected in 2014 and aerial photography on Google Earth Pro (2014) and include residential structures, chicken houses, garages, barns, schools, commercial buildings, fire departments, convenience stores, and churches.

4.9.1.1 Glades Reservoir Alternatives

River Water Transmission System

The raw water intake and pump station would consist of a small two-story building along the bank of the Chattahoochee River. Impacts to the surrounding environment, roadways, businesses, and residences from construction traffic and land disturbing activities are expected to be minimal and temporary. Short-term construction impacts could cause delays on roads or inconveniences to local communities; however, access would be maintained during construction and no long-term impacts are anticipated. No structures would be displaced due to this component of the alternative.

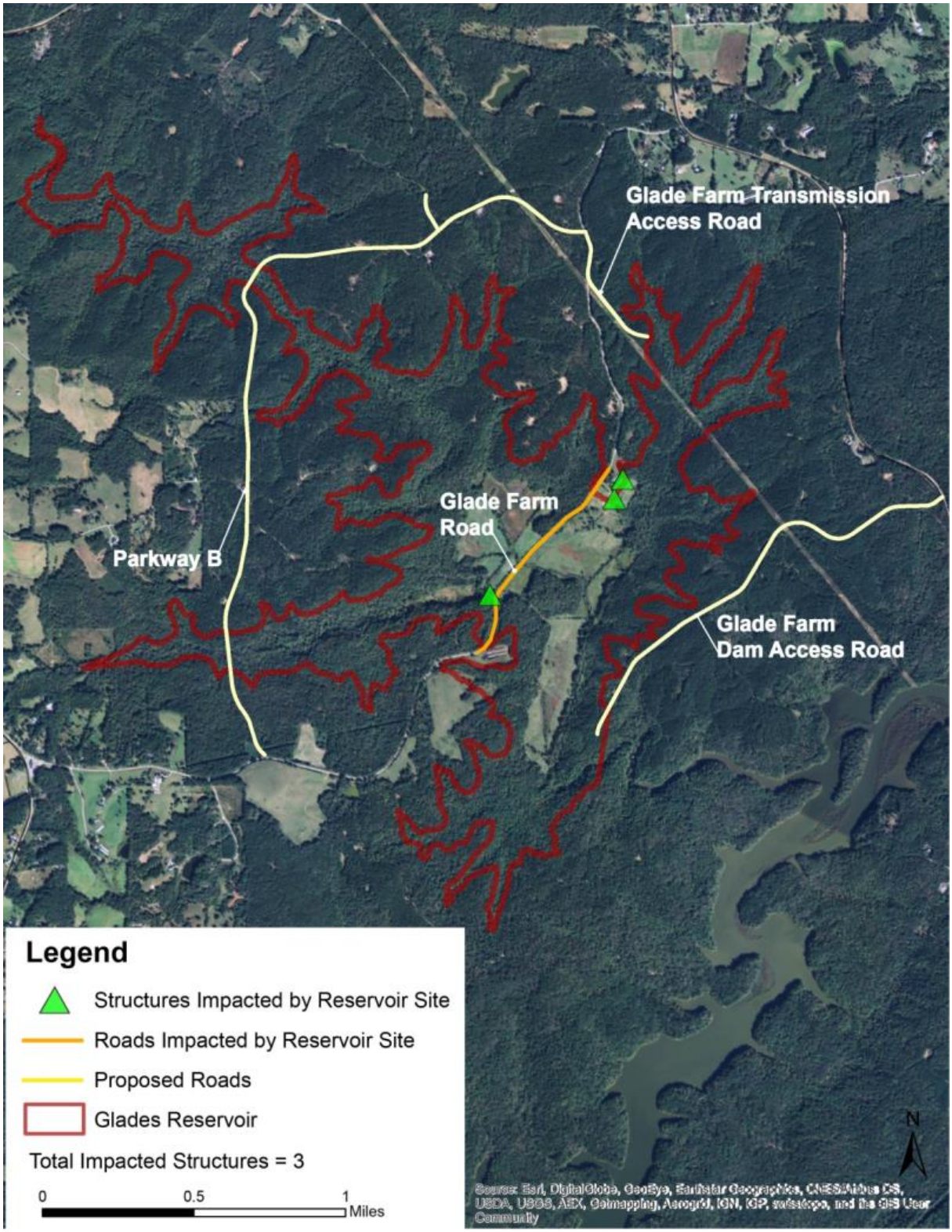
Reservoir

Structure displacement as a result of reservoir construction and flooding was analyzed based on the flood pool water surface area of the reservoir (see **Figure 4.82**). Based on the evaluation, no home sites would be displaced. Three structures one chicken house, one residential barn, and one residential out-building are located along the 0.8 mile stretch of Glade Farm Road within the reservoir flood pool area and would be displaced. The construction of the reservoir would not displace or bisect any existing communities. The rural setting of the existing community would be retained; however, the setting would be converted from wooded areas to a water feature. **Table 4.61** depicts the number and types of structures impacted by the Glades Reservoir.

Table 4.61 Type of Structure Impacted by Glades Reservoir

Structure Type	Number of Impacted Structures
Residential	0
Commercial	0
Residential Out Building	1
Chicken House	1
Residential Barn	1
Total Number of Impacted Structures	3

Figure 4.82 Glades Reservoir Communities and Roads



Three new roads would be constructed as part of the reservoir project.

1.) Glade Dam Access Road to provide access to the dam (approximate length 0.4 miles)
2.) Glade Transmission Main Access Road to provide access to the river water transmission main (approximate length 1.5 miles)
3.) Parkway B Alignment to serve as a detour/relocation for Glade Farm Road (approximate length 2.9 miles)

These roads will run predominantly through undeveloped woodlands, or adjacent to existing utility or road ROW. No structures would be impacted as a result of the new roads.

Glade Farm Road is the only existing road to be impacted by the reservoir is Glade Farm Road. Approximately 0.8 mile of Glade Farm Road would be located within the reservoir boundary and flooded with project implementation. The new Parkway B Alignment would serve as the detour. Parkway B Alignment would re-route traffic off Glade Farm Road around the northern portion of the reservoir, connecting the east and west sides of Glade Farm Road flooded by the reservoir. The detour will add approximately 0.5 mile to trip distances for vehicles traveling along Glade Farm Road as compared to the existing condition.

The number of people impacted by the need to drive along the re-routed Glade Farm Road is low. This road currently carries small volumes of traffic, based on the low population density along Glade Farm Road and the small traffic volumes carried along roadways at both ends of Glade Farm Road. However, limited recreational activities would be allowed at the reservoir (e.g., picnicking and walking trails), and these opportunities may draw visitors and have the potential to increase travel along the re-routed Glade Farm Road.

Table 4.62 Glades Reservoir Road Impacts

Existing Road within Reservoir Footprint	Approximate Distance Impacted (miles)	Detour Details	Change in Driving Distance between Existing Condition and Re-Routed Road (additional miles)
Glades Farm Road	0.80	A new roadway and bridge will be constructed to the north of the existing roadway that will be inundated. Length of relocated road is estimated to be 2.9 miles. Existing distance along Glade Farm Road between the detour tie-in points is 2.4 miles.	<0.5 mile

A short-term increase in construction traffic (e.g., logging vehicles, cranes, bulldozers, etc.) is expected as dam and new roadway construction occurs. Dam construction is expected to last 3 years and would lead to increases in localized traffic, which would cause inconvenience for motorists along Glade Farm Road and other roads in the vicinity. However, construction of the reservoir sites, transmission systems (river and reservoir), and roadways will occur in phases; therefore, the impacts due to construction traffic are mitigated by not occurring all at once.

Reservoir Water Transmission System

To Lakeside WTP

The transmission main that would travel to Lakeside WTP would be buried underground, except for the crossing of the Chattahoochee River (under riverbed). Because the transmission main would be underground, impacts to the surrounding environment, roadways, businesses, and residences via construction traffic and land disturbing activities are expected to be short-term; there are no structural or roadway displacements, nor any long-term impacts to the local communities. The booster pump station would be located on approximately one acre of undeveloped land; therefore no structural or roadway displacements are expected as a result of the pump station. However, the new booster station may have a visual and noise impact to local communities, depending on final site selection.

WTP

The new Glades WTP would be located on the western side of the reservoir on undeveloped land that does not consist of any roadways or structures. The transmission main that would travel 500 feet from the reservoir to the new WTP site would be buried underground. Impacts to the surrounding environment via construction traffic and land disturbing activities are expected to be short-term; no structural or roadway displacements would occur. The expansion of Lakeside WTP is expected to have short-term impacts from construction traffic and land disturbance activities and would not affect any existing roadways or community infrastructure long-term.

4.9.1.2 White Creek Reservoir Alternatives

River Transmission System

The raw water intake and pump station would consist of a small one-story building along the bank of the Chattahoochee River. The river water transmission main to White Creek Reservoir would be buried underground. Therefore, impacts to the surrounding human environment, roadways, businesses, and residences from construction traffic and land disturbing activities are expected to be short-term. Short-term construction impacts could cause delays on roads or inconveniences to local residents and businesses; however, access would be maintained during construction and no long-term impacts are anticipated. No incorporated communities are located in the immediate vicinity. No structures would be displaced as a result of the river transmission system and no long-term impacts would occur.

Reservoir

The White Creek Reservoir site is located within unincorporated White County. There are 37 structures found within this reservoir flood pool surface area, consisting of houses, residential out-buildings, and several commercial structures. **Figure 4.83** shows the displacements associated with the reservoir site. Two structures located outside of the reservoir footprint would be displaced because access to these structures would be flooded and a detour is not available. Additionally, the new roadways and bridges associated with the reservoir construction would displace two homes and two residential out-buildings. In summary, a total of 42 structures would be displaced by the construction of the White Creek Reservoir and associated roads. **Table 4.63** below depicts the number and types of structures impacted by the White Creek Reservoir.

Figure 4.83 White Creek Reservoir Communities and Roads

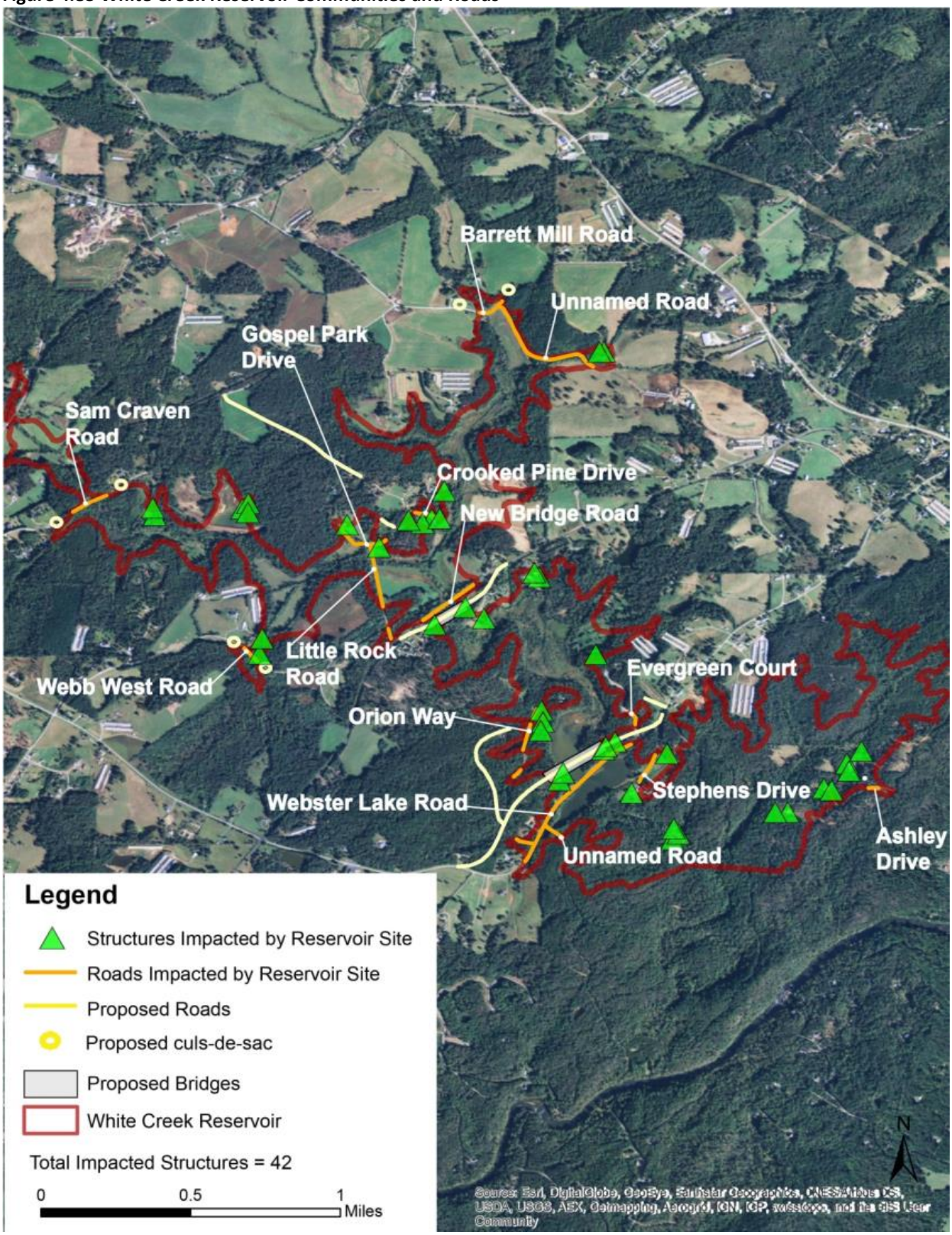


Table 4.63 Type of Structure Impacted by White Creek Reservoir Alternatives

Structure Type	Number of Impacted Structures
Residential[1]	19
Residential Out-Building[2]	6
Residential Barn	9
Commercial	3
Chicken House	1
Concrete Slab	1
Other (i.e., Pool, Boat Dock, Unknown)	3
Total Number of Impacted Structures	42

[1] Includes two structures displaced due to new roads and one structure displaced due to access road displacement.
[2] Includes two structures displaced due to new roads.

Reservoir Site

Thirteen existing roads are located within the White Creek Reservoir footprint and would be impacted by the construction of the new reservoir. **Table 4.64** indicates the length of each existing road that would be impacted by the White Creek Reservoir, details of the detour, and provides additional distance a driver would expect to travel under project implementation as compared to the existing condition.

Table 4.64 White Creek Reservoir Road Impacts

Existing Road within Reservoir Footprint	Approximate Distance Impacted (miles)	Detour Details	Change in Driving Distance between Existing Conditions and Re-Routed Road (additional miles)
Webster Lake Road	0.50	A new roadway and bridge will be constructed to the north of the existing roadway that will be flooding.	<0.1 mile
Stephens Drive	0.10	No detour. This portion of the road will be flooding with no detour available, as the structures accessed by this portion of the roadway will also be flooding.	Not applicable; this road is a dead end leading to no additional roads.
Unnamed Road	0.10	No detour. This portion of the road will be flooding with no detour available, as the structures accessed by this portion of the roadway will also be flooding.	Not applicable; this road is a dead end leading to no additional roads.
Orion Way	0.20	A new roadway will be constructed to the west of the existing roadway that will be flooding.	<0.1 mile
New Bridge Road	0.18	A new roadway and bridge will be constructed to the south of the existing roadway that will be flooding.	<0.1 mile
Little Rock Road	0.30	The northern terminus of the road will be extended northwest to Barrett London Road. The southern portions of the existing roadway will be flooding with no detour available. Any structures located on these portions will be flooding as well.	0.4 mile
Gospel Park Drive	0.13	This portion of the road will be flooding and a new access road off Little Rock Road will be available. A detour will result in 4 additional miles between the old and new driveways; depending on driver travel patterns, this distance may be more or less than currently experienced	4 miles-
Barrett Mill Road	0.10	No detour. This portion of the road will be flooding with no detour available; the roadway on both sides of the reservoir will now end in a cul-de-sac. There are no structures located along this portion of the roadway.	2.7 miles
Sam Craven Road	0.10	No detour. This portion of the road will be flooding with no detour available; the roadway on both sides of the reservoir will now end in a cul-de-sac. There are no structures located along this portion of the roadway.	2.5 miles
Webb West Road	0.10	No detour. This portion of the road will be flooding with no detour available; the roadway on both sides of the reservoir will now end in a cul-de-sac.	2.3 miles
Evergreen Court	0.05	A new roadway will be constructed to the east of the existing roadway that will be flooding.	0.1 mile
Crooked Pine Drive	0.10	No detour. This portion of the road will be flooding with no detour available. The structure located along this portion of the roadway will be considered a displacement.	Not applicable; this road was a dead end leading to no additional roads.
Ashley Drive	0.03	No detour. This portion of the road will be flooding with no detour available. There are no structures located along this portion of the roadway.	Not applicable; this road was a dead end leading to no additional roads.

The number of people impacted by the need to use these thirteen roads is low. These roads currently carry low volumes of traffic, based on the low population density and the low volumes carried along roadways (e.g., Webster Lake Road has an Average Annual Daily Traffic [AADT] of 880 vehicles per day [VPD]; New Bridge Road has an AADT of 740 VPD; and Sam Craven Road has an AADT of 1,820 VPD). Limited recreational activities would be allowed at the water supply reservoir; however, this is not expected to increase travel along the re-routed roads significantly.

Reservoir Water Transmission System

The transmission mains from the White Creek Reservoir to the Lakeside WTP would be buried underground, except for the crossing of the Chattahoochee River (buried under river bed). Impacts to the surrounding environment, roadways, businesses, and residences from construction traffic and land disturbing activities are expected to be short-term. The booster pump station would be situated on approximately one acre of undeveloped lands adjacent to existing road ROW outside of residential neighborhoods. There are no anticipated permanent structural or roadway displacements from the construction of the transmission main or the booster pump station. However, the new booster station may have a visual and noise impact to local communities, depending on the final site selection.

4.9.1.3 No Action Alternative

The No Action Alternative is one in which no project would be implemented and indirect impacts to communities, housing, or transportation would occur in the short term.

However, development pressures in the metro-Atlanta region, and specifically in Hall County, could result in community impacts. In particular, as the population ages, Hall County, Lake Lanier region, and the bedroom communities of White and Habersham counties could become attractive to retirees and others. The undeveloped areas in proximity to Lake Lanier could receive development pressures and bring new homes/businesses to the area. This is a reasonably foreseeable outcome, based on general development patterns. Regardless of the Proposed Project's implementation, development would be anticipated and could have long-term impacts on the roads and housing distribution in the Glades Reservoir vicinity.

Table 4.65 summarizes the impacts of the alternatives.

Table 4.65 Summary of Housing/Community/Transportation Impacts

Alternative #	Alternative ID	Impacts to Housing/Communities/Transportation
Applicant	L18-G50-PT	Long-term impact of reservoir; a total of 3 structures would be impacted. Long-term impacts due to construction of 3 new roads, flooding of existing Glade Farm Road, and an increase in traffic volume on access roads. Short-term impacts due to construction traffic.
1	L18-G42-PT	Long-term impact of reservoir; a total of t3 structures would be impacted. Long-term impacts due to construction of 3 new roads, flooding of existing Glade Farm Road. Short-term impacts due to construction traffic.
2	L18-G42-PL	Long-term impact of reservoir; a total of 3 structures would be impacted. Long-term impacts due to construction of 3 new roads, flooding of existing Glade Farm Road. Short-term impacts due to construction traffic. Small, localized impact due to visual and noise for communities near booster pump station and for recreational community due to pump station at the bank of Chattahoochee River. Short-term impacts due to construction and associated construction traffic.
3	L18-G42-WTP	Long-term impact of reservoir; a total of 3 structures would be impacted. Long-term impacts due to construction of 3 new roads, flooding of existing Glade Farm Road. Long-term impact due to new WTP with no displacements. Short-term impacts due to construction and associated construction traffic.
4	L30-G30-PT	Long-term impact of reservoir; a total of 3 structures would be impacted. Long-term impacts due to construction of 3 new roads, flooding of existing Glade Farm Road. Short-term impacts due to construction traffic.
5	L30-G30-PL	Long-term impact of reservoir; a total of 3 structures would be impacted. Long-term impacts due to construction of 3 new roads, flooding of existing Glade Farm Road. Long-term, localized impact due to visuals and noise for communities near booster pump station and for recreational community due to pump station at the bank of Chattahoochee River. No displacements due to booster pump station or transmission lines. Short-term impacts due to construction and associated construction traffic.
6	L30-G30-WTP	Long-term impact of reservoir; a total of 3 structures would be impacted. Long-term impacts due to construction of 3 new roads, flooding of existing Glade Farm Road. Minimal impact due to new WTP with no displacements. Short-term impacts due to construction and associated construction traffic.
7	L43-G17-PT	Long-term impact of reservoir; a total of 3 structures would be impacted. Long-term impacts due to construction of 3 new roads, flooding of existing Glade Farm Road. Short-term impacts due to construction traffic.
8	L43-G17-PL	Long-term impact of reservoir; a total of 3 structures would be impacted. Long-term impacts due to construction of 3 new roads, flooding of existing Glade Farm Road. Long-term, localized impact due to visuals and noise for communities near booster pump station and for recreationalists due to pump station at the bank of Chattahoochee River. No displacements due to booster pump station or transmission lines. Short-term impacts due to construction and associated construction traffic.
9	L43-G17-WTP	Long-term impact of reservoir; a total of 3 structures would be impacted. Long-term impacts due to construction of 3 new roads, flooding of existing Glade Farm Road. Long-term impact due to new WTP with no displacements. Short-term impacts due to construction and associated construction traffic.
10	L43-W17-PT	Long-term impact from perspective of nearby residences and commercial operations; a total 37 structures would be impacted due to the reservoir footprint. Long-term impact due to new roadways, which require the displacement of 5 structures, and the displacement of 13 existing roadways, requiring roads to be re-routed. Short-term impacts due to construction and associated construction traffic.

Alternative #	Alternative ID	Impacts to Housing/Communities/Transportation
11	L43-W17-PL	Long-term impact from perspective of nearby residences and commercial operations; a total of 37 structures would be impacted due to the reservoir footprint. Long-term impacts due to new roadways, which require the displacement of 5 structures, and the displacement of 13 existing roadways, requiring roads to be re-routed. Long-term, localized impact of pump station for recreational community at Chattahoochee River. Short-term impacts due to new construction and associated construction traffic.
No Action	L60	Short-term impacts due to development pressures in region.

4.9.2 Demographics and Environmental Justice

4.9.2.1 Background

In accordance with efforts for this project to comply with Executive Orders (EO) 12898 and 13166 (see Chapter 3), an analysis was conducted to identify potential environmental justice populations along the affected area of the Proposed Project and alternatives. U.S. Census Data was used to identify minority or low-income communities. The environmental justice analysis includes all U.S. Census block groups that fall fully or partially within the project areas for both Glades Reservoir and the White Creek Reservoir alternatives. The analysis examined a total of 19 block groups that are within the project area.

Comparing the percentage of low income or minority population in the project area to the percentage of the same population in a geographically larger reference area, such as the county or the state, establishes the presence/absence of a low income or minority population and potential for disproportionate adverse impacts (per EO 12898). To provide a more localized “county” reference for this analysis, Hall County was chosen as the geographic comparison area for Glades Reservoir, White County was chosen as the geographic comparison area for White Creek Reservoir. In addition, Habersham County was used as the geographic comparison area for one block group located in Habersham County that is along the transmission main route.

An environmental justice population or community in this analysis was defined to include any census block group in which the minority or low-income population meets either of the following thresholds:

a) Minority or low-income population in the census block group exceeds 50 percent; or

b) Percentage of a minority or low-income population in the affected area is greater than the reference county average.

The 2010 Decennial U.S. Census was used to identify minority populations. The American Community Survey (ACS) 5-year average data (2008-2012) was used to identify low-income populations (the most recent years that published low-income data are available).

4.9.2.2 Affordable Housing Assessment

The U.S. Department of Housing and Urban Development (HUD) Affordable Apartment Search website (http://www.hud.gov/apps/section8/) and the Public Housing Agency (PHA) website (http://portal.hud.gov/hudportal/HUD?src=/program_offices/public_indian_housing/pha/contacts) were used to determine the location of affordable housing in the area. Housing choice vouchers, the federal government's major program for assisting very low-income families, the elderly, and the disabled, are administered locally by PHAs. The PHAs receive federal funds from HUD to administer the voucher program.

Based on a review of the information available on the HUD websites, it was determined that there are no public housing facilities within the immediate vicinity of the proposed Glades Reservoir and White Creek Reservoir alternatives that would be impacted by their construction.

4.9.2.3 Environmental Justice Analysis

Due to the geographic scale of the census tracts, alternative components were combined into Environmental Justice Study Areas for this environmental justice analysis. Each study area may include multiple census tracts and block groups.

Table 4.66 shows minority and low-income demographics by block group and census tract data for geographic areas in which project alternative footprints are located. Each block group is located within a census tract, and provided a specific nomenclature for the area, (e.g., CT 000101/BG 1, which means in Census Tract 000101, Block Group 1, the data is applicable). For each block group, the study areas that it contains are shown as superscript in the first column. Block groups designated as minority are highlighted in blue, and block groups designated as low income are highlighted in pink. The populations of the reference counties and the State of Georgia are shown at the top of the table.

Glades Reservoir Alternatives

A summary of study areas identifying block groups and impacts to minority and low-income populations is provided below.

Study Area A - Glades Reservoir/River Transmission System / Roadways (Alternatives 1, 4, 7)

Study Area A in **Table 4.66** is contained within three block groups (1, 2, and 3), all within Census Tract (CT) 00201 in Hall County. None of the block groups have minority populations 50% or greater than the minority percentage for Hall County, but one block group (BG 3) is greater than Hall County's low-income population (21.4% of its population is below the poverty line) and therefore, is designated as low-income. Three (3) structures would be displaced as a result of the project in this area, but none are primary residences; therefore, no low-income populations would be impacted by the project in this area. No disproportionately short-term or long-term impacts to low-income residents or populations would occur in Study Area A.

Study Area B- Reservoir Transmission System to Lakeside WTP (Alternatives 2,5,8)

Study Area B in **Table 4.66** is contained within 18 block groups in Hall County. Four of these block groups are designated only as Minority, and three are designated as both Minority and Low-Income. A total of

seven minority and three low-income block groups occur in Study Area B. No displacements would occur as a result of the project in this area; therefore, no low-income or minority populations would be impacted by the project in this area. No disproportionately short-term or long-term impacts to low-income or minority residents or populations would occur in Study Area B.

Study Area C- New Glades WTP, Raw Water Pumping and Transmission System (Alternatives 3,6,9)

Study Area C (**Table 4.66**) is contained within three block groups (1, 2, and 3), all within Census Tract (CT) 00201 in Hall County. None of the block groups have minority populations 50% or greater than the minority percentage for Hall County, but one block group (BG 3) is greater than Hall County's low-income population of (21.4% of its population is below the poverty line) and therefore, is designated as low-income. No displacements would occur as a result of the project in this area; therefore, no Low-Income or Minority populations would be impacted by the project in this area. No disproportionately short-term or long-term impacts to low-income or minority residents or populations would occur in Study Area C.

White Creek Reservoir Alternatives

Study Area D- White Creek Reservoir/River Transmission System /Roadways (Alternative 10)

Study Area D in **Table 4.66** is contained within one block group in White County (CT 950300, BG 1). This block group does not contain minority or low-income populations. Although displacements would occur within this study area, no minority or low-income populations were identified using census data. No disproportionately short-term or long-term impacts to low-income or minority residents or populations would occur in Study Area D.

Study Area E- Reservoir Transmission System to Lakeside WTP (Alternative 11)

Study Area E (**Table 4.66**) is contained within 19 block groups in White, Habersham, and Hall counties. Four of these block groups are designated only as Minority, and three are designated as both minority and low-income. A total of seven minority and three low-income block groups occur within this area. No displacements would occur as a result of the project in this area; therefore, no Low-Income or Minority populations would be impacted by the project in this area. No disproportionately short-term or long-term impacts to low-income or minority residents or populations would occur in Study Area E.

No Action Alternative

The No Action Alternative is one in which no project would be implemented and no impacts would occur to any low-income or minority populations.

The full Environmental Justice analysis table for various ethnic and minority population groups by census tracks and block groups is included in **Appendix V**.

Table 4.66 – Environmental Justice Block Groups (% population and # of people)

County		Minority (2010)	Low- Income Population (2008-2012)
Hall		36.39% 65,384	16.85% 29,747
Habersham		19.56% 8,420	18.10% 7,287
White		6.23% 1,691	17.23% 4,587
Georgia		44.12% 4,273,73	17.41% 1,685,65
Census Tract/Block Group Data [1]			
CT 000101 / BG 1 [B,E]	Hall	13.3% 343	17.5% 390
CT 000101 / BG 2 [B,E]	Hall	11.4% 326	15.1% 346
CT 000102 / BG 2 [B,E]	Hall	12.4% 231	13.7% 231
CT 000201 / BG 1 [A,B,C]	Hall	7.5% 122	7.1% 132
CT 000201 / BG 2 [A,B,C]	Hall	4.9% 69	14.2% 168
CT 000201 / BG 3 [A,B,C]	Hall	29.0% 844	21.4% 613
CT 000600 / BG 1 [B,E]	Hall	22.7% 259	48.3% 720
CT 000600 / BG 2 [B,E]	Hall	25.3% 452	17.1% 351
CT 000602 / BG 1 [D,E]	Habersham	6.4% 90	15.8% 250
CT 000800 / BG 1 [B,E]	Hall	86.1% 800	32.2% 255
CT 001201 / BG 2 [B,E]	Hall	87.0% 1757	69.1% 902
CT 001201 / BG 3 [B,E]	Hall	67.1% 3042	31.2% 1125
CT 001301 / BG 3 [B,E]	Hall	45.5% 832	9.9% 229
CT 001403 / BG 2 [B,E]	Hall	38.0% 743	16.0% 417

CT 001404 / BG 1 [B,E]	Hall	47.1% 1630	10.8% 371
CT 001404 / BG 3 [B,E]	Hall	44.3% 285	15.9% 78
CT 001501 / BG 1 [B,E]	Hall	10.5% 273	3.3% 78
CT 001501 / BG 2 [B,E]	Hall	20.1% 325	3.6% 48
CT 950300 / BG 1 [D,E]	White	3.5% 30	5.24% 50
Environmental Justice Study Areas			
A		2.7% 1035	15.5% 913
B		34.5% 12,333	19.0% 6454
C		17.42% 1,035	15.45% 913
D		3.5% 30	5.24% 50
E		35.6% 11,418	18.4% 5973

[1] Block groups designated as minority are highlighted in blue, and block groups designated as low income are highlighted in pink. Highlighted areas indicate either a) low-income or minority populations are greater than respective county averages or b) low-income or minority populations are greater than 50% of the block group.
Race/Minority Data Source: 2010 Census
Limited English Proficiency/Low-Income Data Source: American Community Survey 2008-2012

Study Area A: Glades Reservoir/River Transmission System (Alternatives 1, 4, 7)
Study Area B: Glades Reservoir/Reservoir Transmission System (to Lakeside WTP) (Alternatives 2, 5, 8)
Study Area C: Glades Reservoir/River Transmission/New Glades WTP (Alternatives 3, 6, 9)
Study Area D: White Creek Reservoir/River Transmission System (Alternative 10)
Study Area E: White Creek Reservoir/Reservoir Transmission System (to Lakeside WTP) (Alternative 11)

4.9.2.4 Unavoidable Adverse Impacts

There would be no unavoidable adverse impacts to environmental justice populations that would result from this project.

Table 4.67 summarizes the environmental justice impacts by alternative.

Table 4.67 Summary of All Alternatives - Environmental Justice

Alternative #	Alternative ID	Environmental Justice Impacts Minority	Environmental Justice Impacts Low-Income
Applicant	L18-G50-PT	None	Negligible
1	L18-G42-PT	None	Negligible
2	L18-G42-PL	Negligible	Negligible
3	L18-G42-WTP	None	Negligible
4	L30-G30-PT	None	Negligible
5	L30-G30-PL	Negligible	Negligible
6	L30-G30-WTP	None	Negligible
7	L43-G17-PT	None	Negligible
8	L43-G17-PL	Negligible	Negligible
9	L43-G17-WTP	None	Negligible
10	L43-W17-PT	None	None
11	L43-W17-PL	None	Negligible
No Action	L60	None	None

4.9.3 Recreation

Recreational activities evaluated for this analysis consist of boating, fishing, and other general water-based activities popular with the Chattahoochee River, Lake Lanier, and downstream. During project scoping and public and agency coordination, recreational access to fishing and boating in the Chattahoochee River and Lake Lanier and reservoirs below Buford Dam was identified as a key issue.

4.9.3.1 Recreational Impacts on Federal Reservoirs in the ACF Basin

Modeling of federal reservoir operations in the ACF Basin using flow records from 1939-2011, a period of 73 years, has provided the foundation for determining potential recreational impacts of the Proposed Project. Based on the modeling results, the recreational impacts of the Proposed Project and its alternatives are limited to the segment of Chattahoochee River below the proposed pump station and Lake Lanier (see Section 4.3 for a discussion of the number of times the lake levels fall below the designated RILs for each federal reservoir). The construction of Glades Reservoir and its alternative components evaluated in this chapter would have negligible to no impact below Lake Lanier (Buford Dam). The three levels of recreational impact for each Federal reservoir are defined by the Corps (as discussed in Chapter 3).

Recreational activities below Lake Lanier (or Buford Dam) along the Chattahoochee River, and at the Jim Woodruff, Walter F. George, and West Point lakes would be essentially unaffected by the project implementation as minimal impacts to water levels would occur (i.e., daily discharge reductions in flow ranging from 0.1% at Jim Woodruff to 1.5% at Buford Dam in 2060). Since the modeling results indicated there are essentially no impact to reservoirs downstream of Buford Dam, the recreation analysis focuses on the areas with the potential to be impacted by the proposed alternatives between the proposed Chattahoochee River intake locations and Buford Dam, including Lake Lanier.

4.9.3.2 Recreational Impacts to Lake Lanier

Comparing the No Action Alternative (L60) to Alternatives 1 to 9 (See Water Use and Management Section for pool values), construction of the Glades Reservoir with various proposed yields would have a beneficial impact (e.g., reduced times the lake level is predicted to fall below the recreational impact level) for Lake Lanier. With the additional storage capacity from Glades Reservoir, the water level at Lake Lanier is predicted to fall below the recreational impact levels less frequently (36 times) as compared to the No Action Alternative (38 times) when all of 2060 demand is met by Lake Lanier water supply storage allocations. The Applicant's Proposed Project, with higher pumping from the Chattahoochee River and higher reservoir yield, is predicted to result in higher number of times when the lake level falls below the recreational impact level for Lake Lanier.

When comparing the White Creek Reservoir alternatives (Alternatives 10 and 11) and the Glades Reservoir alternatives (Alternatives 1-9), the Glades Reservoir alternatives have less recreational impacts than the White Creek Reservoir alternatives. The White Creek Reservoir alternatives are not predicted to have beneficial impact to Lake Lanier recreational activities. In fact, Alternative 11 (with water pumped from the reservoir to Lakeside WTP directly) is shown to have a slight adverse impact to water levels; the model predicted that water level would fall below the recreational impact level 39 times as compared to the No Action Alternative (38 times) for the 73 years of record analyzed.

In summary, minimal impacts to recreational boating and fishing would occur at Lake Lanier for Alternatives 1 to 9. Glades Reservoir would provide beneficial recreational impacts for Lake Lanier.

4.9.3.3 Recreational Impacts to Chattahoochee River below the Proposed Intakes

This section describes the methodology and criteria used to assess recreational impacts, as well as the impacts to the segment of Chattahoochee River between the proposed intake and Lake Lanier.

Methodology

Critical flow period for habitat and recreational impact analysis was identified as the spring months of February through May.

Through coordination with Georgia WRD, the critical flow period for habitat and recreational impact analysis was identified as the spring months of February through May. This is the spawning season for the transient game fish, as well as a popular period for boaters and anglers (see **Appendix O**). WRD indicated that the most popular period for boaters to travel up the Chattahoochee River from Lake Lanier is generally during the spring fish spawning runs (a local recreational outfitter also confirmed that spring is the most popular season); however, many fishermen limit their travel to Belton Bridge, where the river exhibits more sandbars (shoals). The game fish spawning period draws anglers and boaters (e.g., motorboats, kayaks, and canoes) alike. Any change in flow regime along the shallow areas as a result of project implementation could potentially affect the game fish spawning, as well as anglers and boaters who are influenced by the availability of fishing. This analysis focused on the shoals, which are the critical areas that could be impacted by low flows. The PHABSIM modeling

conducted for this DEIS to evaluate impacts to fish community (**Appendix O**) identified shallow choke points at shoals SC-1 and SC-2 as potentially most affected by low flow conditions.

Figure 4.84 shows the locations along the Chattahoochee River that could be impacted by fluctuations in water levels, including several choke points (SC-1, SC-2, CCR-2) susceptible to low flows, specifically shallow shoals areas. SC-1 is located south of the proposed Glades intake approximately at the confluence of Mud Creek, while SC-2 is located just north of the proposed Glades intake. CCR-2 is a location surveyed by the Applicant and is approximately at the mid-point of SC-1 and SC-2. To demonstrate how river bed profiles change constantly and significantly, river bed profile at a "slow deep" (SD-1) location on the river was also plotted. SD-1 is located just upstream of SC-2 and the Glades intake. In addition, locations for boat ramps, hand launch, and recreational areas including state and county parks and wildlife management areas are shown.

Recreational flow criteria were established to assess the impacts for both fish spawning and boating needs. The flow criteria were established based on both equivalent water depths in shallow areas and flow/water depth correlated using the PHABSIM model at critical shallow choke areas. Flow criteria for respective intake locations were developed based on 1) PHABSIM habitat modeling results, and 2) drainage area ratio for flow correlation at the intake. Water depths for boating and canoeing were determined based on best available research, discussions with WRD, local outfitters, and experiences from boaters and canoers/kayakers. The impact on river recreation, in particular, boating and fishing, were assessed based on the following criteria:

Fish spawning and year-round fishing: streamflow criteria (expressed as % AADF) at the proposed intake locations were established to assess the impacts:

- **Minimum flow for transient game fish spawning**: **5% AADF** (46 cfs at the Glades intake and 39 cfs at the White Creek Reservoir intake). Adverse impacts to transient game fish spawning could occur if flow at intake is less than 5% AADF, especially those occurring within the shallow/fast riffle habitats. Sufficient water depth is needed in the shallow areas to allow upstream migration of transient species for migrating striped bass, walleyes, and white bass.
- **Minimum flow for year-round resident fish community**: **10% AADF** (92 cfs at the Glades intake and 79 cfs at the White Creek Reservoir intake). Adverse impacts to the resident fish community could occur if the flow at the intake is lower than this value.
- **Minimum flow for year-round fishing: 17% AADF (A7Q10)** (154 cfs at the Glades intake and 131 cfs at the White Creek Reservoir intake). Adverse impacts to year-round fishing (for both game and nongame fish species) could occur if the flow at the intake is lower than this value.

Boating and Canoeing: water depth is used to assess the impact.

- **Minimal canoeing/kayaking depth**: Approximately 18 inches of water depth in the shallow points of the river are required to provide a good to excellent (see text box next page) kayaking experience for a person of average weight. According to a local recreational outfitter, the water depth in the upper Chattahoochee River can range from 6 inches to 6 feet in various sections of

the upper Chattahoochee River. Rental of canoe/kayak equipment is possible with a minimum of 6 inches of water depth during low flow periods. However, based on conversations with experienced kayakers, a water depth of 12 inches is considered minimum to provide a reasonably satisfying experience. Although some people may be willing to drag their canoes or kayaks in shallow water (3 to 6 inches), many would not risk such an extraneous experience during low flow periods. Therefore, this DEIS chooses a more conservative criteria (18-inch water depth) to assess the impacts on canoeing/kayaking. The 18-inch water depth is equivalent to approximately 10% AADF at the respective intake locations.

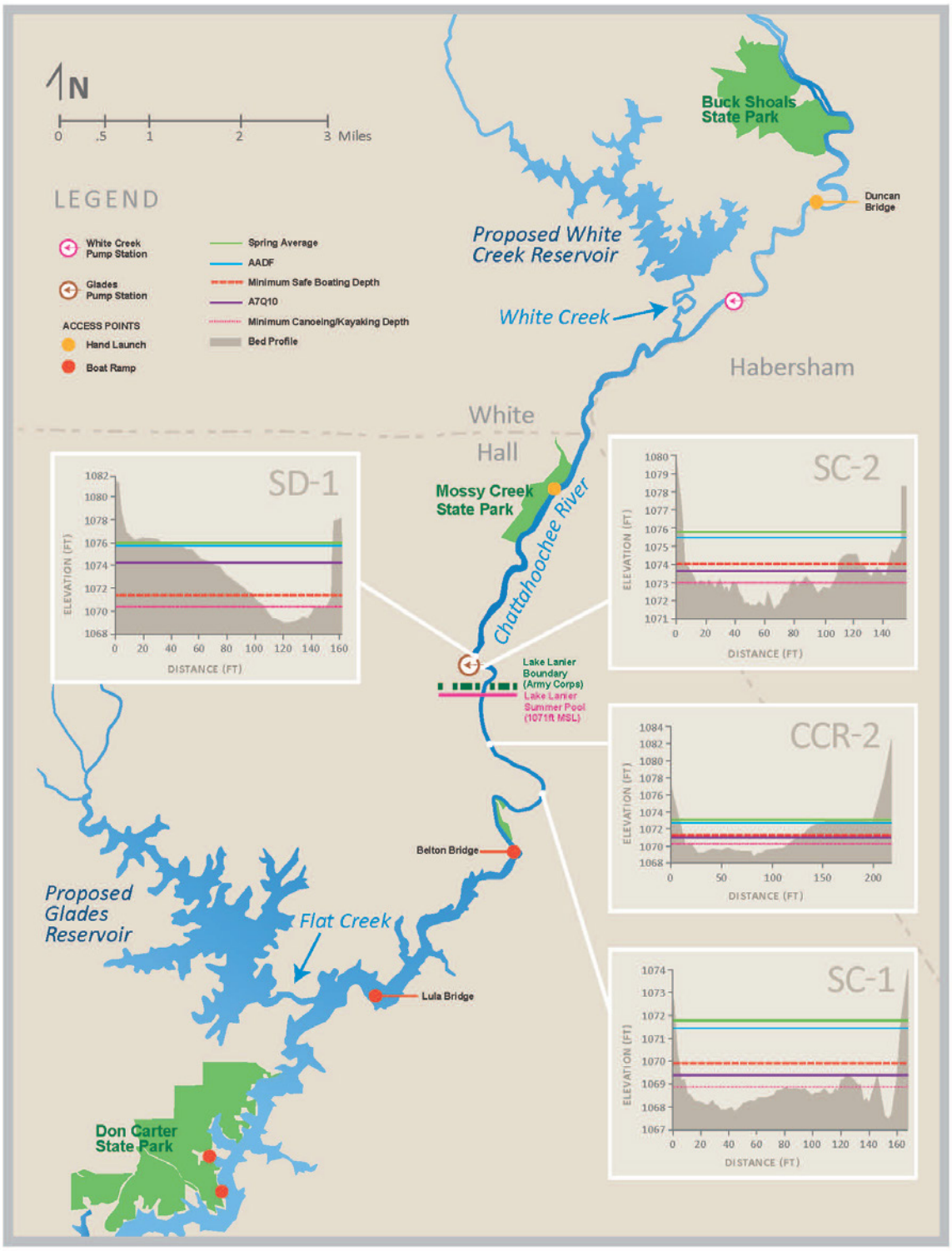
- **MSBD** - requires approximately 30 inches of water depth. This water depth is equivalent to 30% AADF at respective intake location (276 cfs at the Glades intake and 236 cfs at the White Creek Reservoir intake) and would allow a single motor fishing boat to navigate. Below this streamflow, some boats are predicted to navigate with increased difficulty.

According to the American Canoe Association, the following are considered the range of recommended depths for three levels of kayaking experiences:

- Fair: 3-6 inches
- Good: 6-12 inches
- Excellent: 12-36 inches

In general, the water needs to be deep enough to float the kayak and to submerge the blade of the paddle completely (*Outdoor Adventures – Kayaking, 2009, Pamela S. Dillon and Jeremy Oyen – Editors)*. Although these values are quoted in this publication, an "excellent" kayaking experience could be highly personal, depending on factors such as a person's size, weight, skill levels, and preferences. For example, some people may prefer the experience in calmer water while others prefer the thrill of rapids. This DEIS focuses the evaluation to define the percent of time when the river flow may be below the "minimum" levels. The selection of 18 inches of water depth as the evaluation criteria would guarantee "excellent" conditions for both kayaking and canoeing (12 inches would provide good to excellent conditions). At 18 inches of water depth, the width of river available for kayaking or canoeing is generally wider than what is available at 12 inches of water depth.

Figure 4.84 Recreation and Public Access – Chattahoochee River between pump station locations and Lake Lanier (including shallow choke points for assessing fish and boat passages)



For the Chattahoochee River intake for the Glades Reservoir, the minimum streamflows to accommodate migratory fish spawning were established as 30% AADF, or 276 cfs during February through May, minimum flows to accommodate motorized boating were established as 30 inches of water depth, or 276 cfs at the intake, and minimum flows to accommodate canoeing/kayaking were established at 18 inches of water depth, or 92 cfs at the intake. For White Creek Reservoir intake, similar %AADF-based criteria are used for the impact evaluation.

Under the Baseline scenario (without reservoirs), 99.5% of the time (based on a 73-year period of analysis), the natural flows in the Chattahoochee River would be higher than the IFPT flow that was selected to avoid impacts to fishing and boating. In another words, under natural conditions, only 0.5% of the time the streamflow would fall below the level that could negatively affect boating (i.e., 135 days out of 27,029 days analyzed).

A 2-stage IFPT is proposed to be maintained below the Glades intake that would minimize impacts to fishing and provide safe boating depth in the river for anglers. Under this IFPT flow regime, the flow below the Glades intake would be higher than 30% AADF (276 cfs) for February through May, and A7Q10 (154cfs) for June through January (see discussions in Section 4.2.3.4 and **Appendix O**) at all times except when the natural flows in the river are lower than the 2-stage IFPT. When this occurs, pumping to refill the reservoir must stop to allow the natural flows to be maintained. This proposed IFPT regime was designed to protect aquatic species and to minimize impacts to spring spawning below the river intake. The M7Q10 IFPT for the White Creek Reservoir intake would exceed the protection offered by the 2-stage IFPT at the same location.

4.9.3.4 Recreational Impact Summary - Chattahoochee River

Table 4.68 shows the percentage of time the streamflows at the respective river intake for Glades and White Creek Reservoir fall below various recreational flow criteria, including the IFPT, minimum flow equivalent for canoeing/kayaking (10% AADF), year-round fishing, safe (motor) boating/fishing protection thresholds. The frequency for each flow scenario is presented for each alternative at its proposed river intake location.

Because pumping from the Chattahoochee River would stop when the natural flows go below the IFPT established to protect fishing and boating activities in the river, the project and alternatives would not change the Baseline Conditions found naturally in the river during critical drought periods. The additional thresholds identified in the table represent other recreational criteria.

The 10% AADF is the minimum threshold flow equivalent established for the kayaking/canoeing activities (18 inches of water depth). The flow analysis shows that there would be no effect under each alternative as compared to the existing Baseline Conditions.

Pumping from the river to refill the reservoir would decrease the available flow below the intake and increase the frequency in which the flows approach the minimal recreational threshold for small motorboats (30% AADF).

Table 4.69 provides a summary of impacts to recreational activities in the Chattahoochee River.

Table 4.68 Frequency of Flow below Recreational Flow Criteria under various Flow Conditions (1939-2012)

Alternative #	Alternative ID	2-Stage IFPT (154/276 cfs)	10 % AADF - Canoe/Kayak (92 cfs)	16.7% AADF A7Q10 – Year Round Fishing (154 cfs)	30% AADF – Min. Safe Boating Depth (30 inches) (276 cfs)
Baseline-Glades	---	0.50%	0.03%	0.46%	5.98%
Applicant	L18-G50-PT	0.50%	0.03%	0.46%	10.94%
1	L18-G42-PT	0.50%	0.03%	0.46%	9.72%
2	L18-G42-PL	0.50%	0.03%	0.46%	10.22%
3	L18-G42-WTP	0.50%	0.03%	0.46%	10.22%
4	L30-G30-PT	0.50%	0.03%	0.46%	8.13%
5	L30-G30-PL	0.50%	0.03%	0.46%	8.45%
6	L30-G30-WTP	0.50%	0.03%	0.46%	8.45%
7	L43-G17-PT	0.50%	0.03%	0.46%	6.29%
8	L43-G17-PL	0.50%	0.03%	0.46%	6.55%
9	L43-G17-WTP	0.50%	0.03%	0.46%	6.55%
No Action	L60	0.50%	0.03%	0.46%	5.98%
Alternative #	Alternative ID	M7Q10 IFPT (varied)	10 % AADF (79 cfs)	A7Q10 (131 cfs)	30% AADF (236 cfs)
Baseline-White	---	0.37%	0.03%	0.46%	5.98%
10	L43-W17-PT	0.37%	0.03%	0.46%	8.12%
11	L43-W17-PL	0.37%	0.03%	0.46%	8.54%

Table 4.69 Summary of Impacts to Recreational Activities in the Chattahoochee River

Water-Based Activity	Minimum Water Depth/Flow Thresholds	Feb-May	Jun-Jan
Motorboats	30 inches	No impacts	Potential Impacts in shallow areas
Kayaks/Canoes	18 inches	No Impacts	No Impacts
Fishing	92 cfs for Glades intake, and 78 cfs for White Creek Reservoir intake	No Impacts	No impacts

Table 4.69 can be summarized as below:

1. Anglers would not be affected during the spring spawning months as the IFPT is sufficient to protect the fishing experience.

2. Under each alternative with the operation of the pumped-storage reservoir, recreational motor boaters and fishermen would notice that the river flows approach and reach the 30% AADF levels at an increased frequency. Pumping to refill the reservoir would result in the increased frequency of streamflow approaching these lower flow threshold that would affect boating, recreationalists may have a slightly different river recreational experience, especially in shallow areas, as compared to Baseline Conditions.
3. Recreational kayakers/canoers would not be anticipated to experience any changes in frequency to the minimal thresholds established for these activities.

February through May Impacts

The average daily flows during the spring months of February to May are 1,229 cfs at the Glades intake. The Fish Community Impact Evaluation (**Appendix O**) also indicated that the native game fish species that are year-round residents of the Chattahoochee River are very adaptable, and are able to thrive in a wide range of habitats in rivers and lakes. These fish are impacted little by any of the flow scenarios. In fact, the most favorable spawning habitat for these species occurred at 5% AADF flows. These flows would not be anticipated to negatively impact fishing stocks and recreational anglers.

The 30% AADF flow level also is sufficient to satisfy safe boating depth for small motorboats, as well as recreational canoeing/kayaking. Therefore, the Proposed Project and alternatives would not adversely affect recreational boating at these flows. Safe navigation would generally be limited to daylight hours due to the unpredictability of the sub-surface water conditions and potential for rocks.

June-January Impacts

Based on PHABSIM modeling results, the A7Q10 (17% AADF) flow is sufficient to support year round resident game and nongame fish species in habitat quality and quantity during all months of the year. This time period of the year is not critical to fish spawning. The migratory game fish that spawn between February and May do not generally remain in the river habitat throughout the year. These flows would not be anticipated to negatively impact fishing stocks and recreational anglers.

During the June to December timeframes, recreational boaters may fish for resident game fish or enjoy boating on the river. During these months, the flows in the Chattahoochee River are naturally lower than during springtime, motorboats with small outboard engines are estimated to experience some difficulties in navigating channels through narrow or shallow shoals when the flow is below 30% AADF (276 cfs) as flow levels approaches A7Q10 (154 cfs) at the Glades intake location (see **Table 4.68**). Recreational canoers and kayakers would not experience any difficulties with these alternatives, because the flow below the intake would in general exceed the safe boating depth (i.e., 18 inches or 10% AADF) for canoes and kayakers.

In summary, pumping would not impact recreational boating along the Chattahoochee River during 99.5% of the time, when the flows below the proposed Glades intake would exceed the IFPT targets established for recreational boating for the Proposed Project. The pumping operation would not affect kayakers and canoers, or fish spawning. However, depending on the alternative, pumping could impact

small motorboats by increasing the frequency that flows fall below the safe boating depth/thresholds (30 inches water depth) as compared to normal conditions during the months of June to December. The only time the streamflow would be below minimal recreational thresholds is when the natural streamflow is below the IFPT during drought periods, in this case, no pumping would occur to affect recreational activities below the pump station in the river. .

The potential impacts to navigation are expected to primarily occur only within the shallow choke points of the Chattahoochee River located just south of the proposed river intake for Glades Reservoir, as well as the shallow choke points at the confluence of Mud Creek and Chattahoochee River as shown in **Figure 4.84**.

There would be temporary, major recreational impacts during the construction of the river crossing for the transmission main from the reservoir to the Lakeside WTP for Alternatives 2, 5, 8 and 11. The trenching under the river would result in limited use of the river for all boaters for a period of two weeks.

The impacts to the Chattahoochee River flows downstream of the proposed White Creek intake are similar to the impacts discussed for the Glades Reservoir (see **Table 4.68** above). No impacts from pumping are anticipated for recreational fish spawning and canoeing/kayaking; however, motor boaters could experience adverse impacts due to increased frequency of lower flows during the months of June to December, especially in shallow areas of the river.

4.9.3.5 Flat Creek and White Creek

Flat Creek

Flat Creek would be impounded under all Glades Reservoir alternatives. The previously active Glade Lake would be absorbed into the Glades Reservoir. Positive benefits would occur because the impoundment of the creek; this area is located on private lands and the reservoir would open up these areas for recreational benefits, including trails and picnicking. However, as this is primarily a water supply reservoir the recreational activities and hours open for these activities will be limited and determined by Hall County.

White Creek

White Creek would be impounded under all White Creek Reservoir alternatives. An existing private lake - Webster Lake is located within the proposed White Creek Reservoir footprint. This small recreational lake currently used for boating/fishing would be impacted by all White Creek Reservoir alternatives. Impacts to this resource are considered significant, since the resource will no longer be active as Webster Lake under the White Creek Reservoir alternatives, as it would be absorbed into White Creek Reservoir. However, positive benefits would occur to current users of Webster Lake due to the increased impoundment of White Creek, and the reservoir would result in more fishing opportunities in addition to opening up additional areas for recreational benefits including trails and picnicking. The existing purpose of Webster Lake would be preserved; however, the character would change to be a much larger lake than currently exists. Positive recreational benefits would occur since as a water supply reservoir

walking trails and picnic areas would be constructed around the reservoir; no motorized vehicles would be allowed.

4.9.3.6 Transmission Systems

Alternatives including a transmission main to Lakeside WTP would require a buried crossing under the Chattahoochee River. There would be temporary impacts during the construction period on all recreational activities. No permanent impact is anticipated once the construction of the transmission main is completed and in operation. Therefore, this impact is not considered significant.

4.9.3.7 Parks

No state parks or recreational areas would be impacted by the proposed Glades Reservoir alternatives. The Don Carter State Park, located immediately south of Flat Creek along Lake Lanier (i.e., Chattahoochee River) would not be impacted by the proposed Glades or White Creek reservoirs. Two boat ramps are accessible during the majority of time; the lake would need to be extremely low to not have boat access. Naturally, the lake is lower during winter and periods of drought. Mossy Creek and Buck Shoals State Parks are not anticipated to be affected by pumping for the proposed reservoir.

Positive recreational benefits would occur at the Glades or White Creek reservoirs, since walking trails and picnic areas would be constructed around the reservoir; no motorized vehicles would be allowed.

4.9.3.8 Mitigation

Mitigation for potential adverse effects of pumping water from the Chattahoochee River has been incorporated into the alternatives analysis and results. Since A7Q10 is insufficient to support access by recreational anglers to the upper reaches of the Upper Chattahoochee River during the spring spawning run, and transient game fish species would experience moderate losses of suitable habitat area at this flow, a 2-stage minimum in stream flow protection target (i.e., 30% AADF [Feb-May] and A7Q10 [June-Jan]) has been recommended to mitigate for moderate losses of suitable habitat for transient game fish species and limitations on anglers during these times. Specifically, the IFPT has been implemented to guarantee IFPT that could particularly affect shallow shoals areas (see **Appendix O**). A 2-stage IFPT has been developed to accommodate IFPT to mitigate potential concerns from critical flow period from February to May.

Construction of pipeline crossing of the Chattahoochee River would occur during low flow times to minimize disruption of recreational activities.

4.9.3.9 Adverse Effects

The primary potential for adverse effects is during a few days in June to January in locations along the Chattahoochee River where water would flow under 276 cfs, which would affect small motorboats. Although this effect would be considered adverse, it is anticipated to occur on limited occasions outside of the springtime fish spawning season, which is the most popular season for fishermen in small motorboats on the Chattahoochee River.

4.9.3.10 Summary

Table 4.70 provides a summary of all impacts for each alternative.

Table 4.70 Summary of All Alternatives - Recreation

Alternative #	Alternative ID	Recreation Impacts
Applicant	L18-G50-PT	Limited Chattahoochee motorboat access during A7Q10 flows Jun to Jan; Limited Lake Lanier recreational impacts
1	L18-G42-PT	Limited Chattahoochee motorboat access during A7Q10 flows Jun to Jan; Limited Lake Lanier recreational impacts
2	L18-G42-PL	Limited Chattahoochee motorboat access during A7Q10 flows Jun to Jan; Limited Lake Lanier recreational impacts; recreationalists view of pump station at Chattahoochee River crossing; temporary disruption of recreation during pipeline construction.
3	L18-G42-WTP	Limited Chattahoochee motorboat access during A7Q10 flows Jun to Jan; Limited Lake Lanier recreational impacts; recreationalists view of reservoir transmission system at Chattahoochee River crossing
4	L30-G30-PT	Limited Chattahoochee motorboat access during A7Q10 flows Jun to Jan; Limited Lake Lanier recreational impacts
5	L30-G30-PL	Limited Chattahoochee motorboat access during A7Q10 flows Jun to Jan; Limited Lake Lanier recreational impacts; recreationalists view of pump station at Chattahoochee River crossing; temporary disruption of recreation during pipeline construction.
6	L30-G30-WTP	Limited Chattahoochee motorboat access during A7Q10 flows Jun to Jan; Limited Lake Lanier recreational impacts; recreationalists view of reservoir transmission system at Chattahoochee River crossing
7	L43-G17-PT	Limited Chattahoochee motorboat access during A7Q10 flows Jun to Jan; Limited Lake Lanier recreational impacts
8	L43-G17-PL	Limited Chattahoochee motorboat access during A7Q10 flows Jun to Jan; Limited Lake Lanier recreational impacts; recreationalists view of pump station at Chattahoochee River crossing; temporary disruption of recreation during pipeline construction.
9	L43-G17-WTP	Limited Chattahoochee motorboat access during A7Q10 flows Jun to Jan; Limited Lake Lanier recreational impacts; recreationalists view of reservoir transmission system at Chattahoochee River crossing
10	L43-W17-PT	Recreationalists view of pump station at Chattahoochee River crossing
11	L43-W17-PL	Recreationalists view of pump station at Chattahoochee River crossing; temporary disruption of recreation during pipeline construction.
No Action	L60	Limited Lake Lanier recreational impacts

4.9.4 Economics

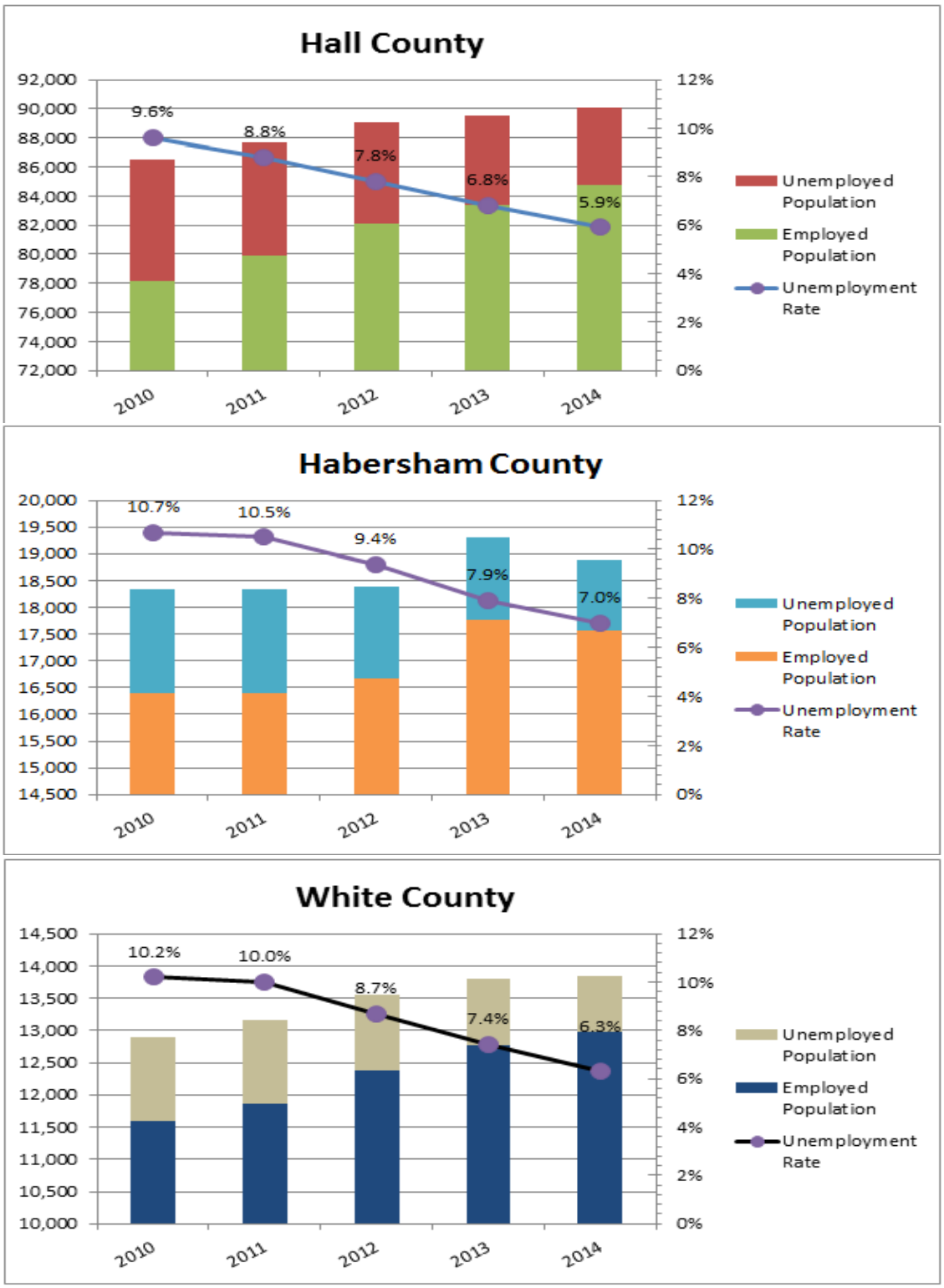
4.9.4.1 Local Economy, Employment and Earnings

The Proposed Project's contribution to the local economy would translate into temporary jobs from construction activities and permanent jobs from the operation and maintenance (O&M) of the facilities.

The increased number of construction jobs is considered short-term beneficial effect limited to the timeframe of project construction. However, as the construction of the infrastructure component would be phased, there would be repeated short-term benefits based on the need for construction. The estimated timeline of implementation of the various elements of project construction is presented in Chapter 2.

Figure 4.85 shows total number of workers, including employed and unemployed for Hall, Habersham, and White counties between 2010 through 2014. This time period follows the recession in 2008-2009. **Figure 4.85** demonstrates a general trend where number of jobs in all three counties increases, while unemployment rate decreases. Hall County has the greatest number of jobs as compared to Habersham and White County's employment.

Figure 4.85 Unemployment Rate 2010-2014 – Habersham, Hall, and White Counties



Source: Georgia Department of Labor

The water supply infrastructure components for each of the alternatives would be constructed within 18-36 months using a workforce ranging from 11 to 142 workers per quarter, or a daily average ranging from 9 -75 staff workers as discussed in Chapter 2. **Table 4.71** provides an overview of the workforce needed for each component of the project. Each of the water supply infrastructure components would be constructed according to the implementation schedule over several years.

Table 4.71 Glades Alternatives Project Average Workforce

Construction Schedule	Reservoir 36 Months	River Transmission System[1] 30 Months	Reservoir Transmission System[2] 36 Months	WTP Expansion or New WTP Construction 36 Months
Year 1				
1st Quarter	16	36	36	70
2nd Quarter	32	36	36	70
3rd Quarter	47	30	30	70
4th Quarter	60	26	30	70
Year 2				
1st Quarter	91	26	26	70
2nd Quarter	121	22	22	70
3rd Quarter	132	22	22	70
4th Quarter	142	21	22	70
Year 3				
1st Quarter	92	6	21	70
2nd Quarter	73	6	13	70
3rd Quarter	53	0	6	70
4th Quarter	44	0	6	70
Daily Average[3]	75	19	23	70
Quarterly Peak	142	36	36	70

Notes:
All numbers shown are average number of workers for the quarter
[1] River transmission system includes the river intake/pump station and the transmission main from the river to the reservoir
[2] Reservoir transmission system includes reservoir intake/pump station, the transmission main from the reservoir to the WTP, and a booster pump station
[3] Daily Average is calculated over the entire construction project

Table 4.72 White Creek Alternatives Project Average Workforce

Construction Schedule	Reservoir 36 Months	River Transmission System[1] 30 Months	Reservoir Transmission System[2] 36 Months	WTP Expansion or New WTP Construction 24 months
Year 1				
1st Quarter	16	36	36	70
2nd Quarter	32	36	36	70
3rd Quarter	47	30	30	70
4th Quarter	60	26	30	70
Year 2				
1st Quarter	91	26	26	70
2nd Quarter	121	22	22	70
3rd Quarter	132	22	22	70
4th Quarter	142	21	22	70
Year 3				
1st Quarter	92	6	21	70
2nd Quarter	73	6	13	70
3rd Quarter	53	0	6	70
4th Quarter	44	0	6	70
Daily Average[3]	75	19	23	70
Quarterly Peak	142	36	36	70

Note: All numbers shown are average number of workers for the quarter

[1] River transmission system includes the river intake/pump station and the transmission main from the river to the reservoir

[2] Reservoir transmission system includes reservoir intake/pump station, the transmission main from the reservoir to the WTP, and a booster pump station

[3] Daily Average is calculated over the entire construction project

A portion of the construction dollars is anticipated to be spent locally, which would create and/or sustain local northeast Georgia income and jobs. Based on the anticipated construction workforce in

Table 4.72, and year 2013 number of jobs in **Figure 4.85**, and assuming the entire workforce would come from a single county, the Proposed Project would contribute a daily average workforce of up to approximately 0.01% to Hall County's overall workforce, 0.5% to Habersham County's workforce, and 1.1% to White County's workforce. However, it is more likely that the construction workforce may come from all three counties and potentially from a greater Hall County area (including all adjacent counties).

The estimated workforce discussed above does not include the contractors to manage the construction efforts for the dam and reservoir, transmission systems, and WTP construction or expansion. Where possible, preference for local businesses and workers will be given for project implementation. Given the proximity of Gainesville to the Glades Reservoir, the city could serve as a potential talent pool for the construction workforce. The goal for the local project sponsor would be to use locally sourced

construction equipment, materials, and supplies, which would benefit local businesses and business owners. These benefits are also considered short-term effects during the life of the construction phases of the project. Construction worker earnings are anticipated to translate into patronage at local businesses as well, creating a secondary benefit to local business income and jobs in the Hall County area.

The project would anticipate hiring additional employees to manage, operate, and maintain the reservoir, as well as the associated WTP for Glades, if selected. At full capacity, the WTP could employ 10-15 people for maintenance and sampling over three shifts covering a 24-hour day of operation. Long-term salaries for these operators would generate small, but positive economic effects.

4.9.4.2 Funding Sources

Hall County submitted an application for the Governor's Water Supply Program in September 2013. Based on this application, the total project costs are anticipated to be approximately $130 million (2013 dollars) including construction and engineering, mitigation, and land acquisition. **Table 4.73** summarizes the anticipated sources of funding according to Hall County's application document.

Table 4.73 Breakdown of Sponsor Funding Sources

Funding Source	Funding Amount ($million dollars)
GWSP Funding	$14.6
Bond Proceeds	$7.6
Tax Revenues	$0
Service or User Fees	$96.3
Private Investment	$0
Other	$11.5
Total Costs	*$129.9*

Source: 2013 GWSP application

The beneficiaries of the project implementation would consist of the entire Hall County population; as such, the water rate schedule assumes project costs would be born by all taxpayers in the county. Based on the application, Hall County would not increase water user rates or fees charged by the City of Gainesville to support capital funding for this project. According to the Hall County application, there are several means by which the $96.3M could be financed. Rather, Hall County anticipates adding an annual flat water fee for approximately 75,000 Hall County tax parcels to contribute to the project costs (excluding the City of Gainesville). For years 0-15 this fee would be $70 annually/tax parcel and from years 16-22, the fee would drop to $50 annually/tax parcel, and after year 22, the fee would be waived.

The average taxes paid per parcel is estimated to be approximately $896, based on 2015 tax revenue estimates of $67 million dollars (source: http://www.hallcounty.org/DocumentCenter/Home/View/632) and 75,000 tax parcels, as stated in the application. An increase of $70/tax parcel for years 1-15 parcel at approximately $896/year (2015 dollars) would constitute approximately 7.8% increase in taxes, while an increase of $50/tax parcel for years 16-22 at approximately $896/year (2015 dollars) would constitute approximately 5.36% increase in taxes.

The user fees proposed by the project sponsor are anticipated to cover 74% of the total project costs (based on the Hall County application). Increases in the number of tax parcels in the county would allow for a greater contribution of the total costs to be covered by the annual user fee. The application states that there is flexibility in these figures based on the potential for an increase in tax parcels, and the county will consider other methods to provide the necessary funding.

As an alternative to the costs proposed by the applicant, the DEIS analysis for total costs of the project implementation are estimated according to **Table 4.74** below. These costs indicate that annual flat user fee for 22 years can contribute a range of approximately 28% and 77% to the overall project costs, depending on which alternative is selected based on the capital costs in the table below, **Table 4.74**. The less expensive alternatives would have a greater proportion of the capital costs paid for by the user fees, while the more expensive alternatives would have a lesser proportion of the capital costs paid for by the user fees.

Table 4.74 Capital Cost Estimates[1,2,3]

Alternative #	Alternative ID	Project Cost ($million dollars)[1]
Applicant	L18-G50-PT	$ 166
1	L18-G42-PT	$ 147
2	L18-G42-PL	$ 344
3	L18-G42-WTP	$ 296
4	L30-G30-PT	$ 138
5	L30-G30-PL	$ 316
6	L30-G30-WTP	$ 232
7	L43-G17-PT	$ 124
8	L43-G17-PL	$ 263
9	L43-G17-WTP	$ 157
10	L43-W17-PT	$ 175
11	L43-W17-PL	$ 338
No Action[2]	L60	$64

[1] Assumptions — costs presented in 2015 dollars; excludes mitigation costs; applicant's proposed estimate has been updated so costs are comparable across alternatives.
[2] Capital cost for No Action Alternative includes costs for expanding the Lakeside WTP only.
[3] The cost excludes fees associated with water withdrawals from Lake Lanier under the Corps' future storage contract agreement; the details of future storage contract and the revised cost are currently under development by the Corps Mobile District.

4.9.4.3 No Action Alternative

The No Action Alternative is one in which no project would be implemented and no economic impacts would occur as a result of the Proposed Project.

4.9.4.4 Mitigation and Monitoring

Neither mitigation nor monitoring is proposed based on the short-term benefits proposed by project implementation.

4.9.4.5 Unavoidable Adverse Impacts

The scope of the economic impacts is based on the construction impacts as a result of project implementation. There are anticipated to be no unavoidable adverse impacts as a result of the Proposed Project or its alternatives. The local economies in Hall, Habersham, and White counties could benefit from any of the alternatives. No economic impacts beyond the scale of these counties would be anticipated due to the negligible effect of the project on water quantity and quality downstream of Buford Dam.

Table 4.75 below summarizes the economic impacts by alternative.

Table 4.75 Summary of All Alternatives - Economic Impacts

Alternative #	Alternative ID	Economic Impacts
Applicant	L18-G50-PT	Short Term benefits due to construction activities.
1	L18-G42-PT	Short Term benefits due to construction activities.
2	L18-G42-PL	Short Term benefits due to construction activities.
3	L18-G42-WTP	Short Term benefits due to construction activities.
4	L30-G30-PT	Short Term benefits due to construction activities.
5	L30-G30-PL	Short Term benefits due to construction activities.
6	L30-G30-WTP	Short Term benefits due to construction activities.
7	L43-G17-PT	Short Term benefits due to construction activities.
8	L43-G17-PL	Short Term benefits due to construction activities.
9	L43-G17-WTP	Short Term benefits due to construction activities.
10	L43-W17-PT	Short Term benefits due to construction activities.
11	L43-W17-PL	Short Term benefits due to construction activities.
No Action	L60	NA

4.10 Visual and Aesthetic Resources

The extent to which the Proposed Project and alternatives affect visual resources depends on the amount of visual contrast created between the proposed facilities and the existing landscape features. Impacts would occur if visual change in the landscape affected existing high quality scenery or the views from, or visual setting of, visually sensitive lands. **Table 4.76** provides a summary of potential visual and aesthetic impacts that could be anticipated from the reservoir alternatives and No Action Alternative.

The visual resources identified for this project include:

- the landscape lines, mixed hardwood forests, riparian zone/floodplains, open fields, and rolling terrain views associated with the rural locations of the proposed reservoirs at Flat Creek (i.e., Glades Reservoir) and White Creek, which are currently viewed primarily by local residences and from local roadways by motorists and bicyclists
- landscape lines, mixed hardwood forests, open fields, and rolling terrain located in the upland areas between the Chattahoochee River and the proposed reservoirs as viewed by local residents, motorists, and bikers
- the landscape lines, mixed hardwood forests, floodplains, and riparian zone of the upper Chattahoochee River as viewed by recreationalists from the river itself, as well as along the banks of the Chattahoochee River

As discussed in Chapter 3, none of these visual resources retain unique aesthetic vegetation areas, are considered visually sensitive lands, or retain geologic formations; similar aesthetically pleasing vistas are found in multiple counties in addition to Hall and White. The quality of the visual resources would remain intact and continue to be appreciated by visitors.

4.10.1 Direct Impacts

The discussion below details the nature of the Proposed Project, the type of impact that would occur to these visual resources, and the characteristics of the proposed impact.

4.10.1.1 Glades Reservoir

Dam and Reservoir Area

The visual resources potentially affected by the reservoir include landscape lines, mixed hardwood forests, riparian zone/floodplains, open fields, and rolling terrain views associated with the rural location of the proposed reservoir at Flat Creek (i.e., Glades Reservoir). Impacts would be long-term due to the nature of the reservoir construction; however, both beneficial and adverse impacts are anticipated to be experienced by a limited population.

The construction of the reservoir would significantly change the Flat Creek floodplain, mixed hardwood forest, open field, and rolling terrain landscape in the Glades Reservoir footprint, converting a primarily second growth forested area to a water body. Although hundreds of acres of hardwood forest, riparian zone, floodplains, and open fields, and would be removed; this new reservoir could also be considered a new scenic resource. As a water supply reservoir, there would be some recreational benefits (e.g.,

picnicking and trails) available to the public in the vicinity of the reservoir. These new recreational areas would open the viewshed to public users.

The population affected by the proposed action would be the few local residents, motorists, bike enthusiasts, and recreationalists. The majority of the reservoir and dam is not visible from surrounding environment. Nearby residences, including National Register of Historic Places (NRHP)-eligible Glade Farm House and Mose Gordon Lumber Co. Mess Hall, would have impacted viewsheds of the new reservoir (see also discussion in **Appendix T**). Therefore, both beneficial and adverse visual impacts would occur as a result of the construction of the proposed reservoir.

The construction of the proposed dam on Flat Creek is located approximately one-half mile upstream from the confluence with the Chattahoochee River, and would be approximately 119 feet in height. Although this structure would be much higher than anything in its surroundings, it likely would not be visible from any points beyond the Glades Farm property, due to the forested buffer that would be retained in the vicinity of the reservoir footprint. Neither existing development nor recreationalists at the Chattahoochee River would be able to see this structure because of its remote location buffered by forest; therefore, the dam would not result in a visual resource impact.

River Water Transmission System

The two visual resources potentially affected by the river water transmission system include: (1) the landscape lines, mixed hardwood forests, open fields, and rolling terrain associated with Flat Creek watershed in the upland areas between the Chattahoochee River and the proposed reservoir; and (2) the riparian zone immediately surrounding the upper Chattahoochee River. Impacts to the viewshed would be short-term impacts related to construction; no long-term structures would be visible once the project is implemented.

The raw water transmission main from the Chattahoochee River southwest to the proposed Glades Reservoir would run approximately four miles adjacent to existing road rights-of-way or undeveloped woodlands and would be buried underground in its permanent condition. Areas adjacent to existing roadways are already cleared. The areas of the pipeline that would run through existing woodlands would have to be cleared for the pipeline, but are unlikely to be visible from developed areas. Any visible areas would be re-vegetated once construction is complete. The transmission main is not anticipated to have any impacts to visual resources between the Chattahoochee River and the reservoir.

The new raw water pump station would be visible to recreationalists along the Chattahoochee River. However, the pump station would have a small footprint in a location surrounded by wooded areas, and could be built of brick or other materials designed to blend with the surrounding environment. In addition, the Chattahoochee River corridor is extensive, and this area is readily avoidable for recreationalists. Since much of the boating and fishing activities take place along the river, the pump station intrusion would occur within a limited area of the user's experience. Therefore, the raw water pump station would have limited long-term visual impacts within the Chattahoochee River viewshed.

Reservoir Water Transmission System

The two visual resources potentially affected by the reservoir water transmission system include: (1) the landscape lines, mixed hardwood forests, open fields, and rolling terrain associated with the Flat Creek watershed in the upland areas between the reservoir and the Chattahoochee River, and (2) the riparian zone of the upper Chattahoochee River.

The proposed transmission system to carry reservoir water from Glades Reservoir to Lakeside WTP would be 25.4 miles, would run primarily along existing roadways (e.g., SR 23), and would be buried underground. However, a small portion of the transmission system would cut through undeveloped areas, and would be visible where it would cross the Chattahoochee River southeast of the proposed reservoir. The booster pump station would be located on an approximately 1-acre lot in an existing developed area outside of the visual resources identified for this project and therefore, not considered to have a visual impact.

Roads

The visual resources potentially affected by the roads include the landscape lines, mixed hardwood forests, open fields, and rolling terrain associated with the Flat Creek watershed in the upland areas between the reservoir and the Chattahoochee River. New roadways would be constructed as a result of re-routing roads impounded by the proposed reservoir. The visual impacts due to the new roadways are not considered adverse, since the roadways consist of a narrow footprint and are located in rural areas or rural residential areas with limited public viewshed. In addition, the construction of roadways in these rural areas would provide drivers the opportunity to experience visual resources across previously inaccessible lands.

Glades WTP

The visual resources potentially affected by the WTP include the landscape lines, mixed hardwood forests, open fields, and rolling terrain associated with the Flat Creek watershed in the upland areas between the reservoir and the Chattahoochee River. Under Alternatives 3, 6, and 9, a new WTP ranging from a 20-acre to 40-acre footprint would be situated in close proximity to the Glades Reservoir. This action would result in a permanent and localized impact, limited to the local motorists, bicyclists, and few residences within the viewshed of this facility. However, mitigation options include increasing a visual buffer with trees that would minimize this impact on the visual resource.

4.10.1.2 White Creek Reservoir

Dam and Reservoir Area

The visual resources potentially affected by the reservoir include landscape lines, mixed hardwood forests, riparian zone/floodplains, open fields, and rolling terrain views associated with the rural locations of the proposed reservoir at White Creek. Impacts would be long-term due to the nature of the reservoir construction; however, both beneficial and adverse impacts are anticipated by a limited population.

The construction of the reservoir would significantly change the White Creek floodplain and landscape area consisting of a mix of agricultural/rural land, undeveloped woodlands, and limited residential properties within the footprint of the White Creek Reservoir by converting the existing terrestrial landscape into a water body. Within much of the reservoir footprint, White Creek has a wide stream valley and associated floodplain, including a small lake (Webster Lake) that would expand in size be absorbed by the White Creek Reservoir. Several properties located within the proposed reservoir area would be physically impacted and displaced. The residential displacements; floodplain, tree canopy and rolling terrain removal; and the conversion of Webster Lake to the reservoir would be considered adverse impacts; however, the scenic benefit of the expanded water feature would be a beneficial impact on the remaining roads and residences surrounding the reservoir. Coves of the new reservoir would extend into previously undeveloped properties, adding a scenic benefit that may entice private development of those lake view properties. As a water supply reservoir, there would be newly available limited recreational benefits (e.g., fishing and trails) in the vicinity of the reservoir. These new recreational areas would open the viewshed to public users. The affected population would consist of the local residents, motorists, and bike enthusiasts, as a sizeable portion of the proposed reservoir viewshed and dam is not visible from surrounding development. Therefore, both beneficial and adverse visual impacts would occur as a result of the proposed reservoir construction.

The White Creek Reservoir dam would be located approximately three-quarters of a mile north of its confluence with the Chattahoochee River. This area is undeveloped and heavily forested. Although the dam height would be significantly higher than its surroundings immediately downstream, it would not likely be visible from developed areas. Neither existing development nor recreationalists at the Chattahoochee River would be able to see this structure because of its remote location buffered by forest. Therefore, the dam construction is not considered as adverse visual impact.

River Water Transmission System

The two visual resources potentially affected by the river water transmission system include: (1) the landscape lines, mixed hardwood forests, open fields, and rolling terrain associated with the White Creek watershed in the upland areas between the Chattahoochee River and the proposed reservoir, and (2) the riparian zone immediately surrounding the upper Chattahoochee River. The raw water transmission pipeline for White Creek Reservoir runs 2,700 linear feet (approximately one half mile) from the Chattahoochee River to the proposed reservoir through undeveloped woodland. Similar to the Glades Reservoir alternative, the White Creek river water transmission system would add a raw water pump station to the intake area on the Chattahoochee River that would be visible to recreationalists on the river. However, the raw water pump station would have a small footprint in a location surrounded by wooded areas could be built of brick or other materials designed to blend with the surrounding environment. In addition, the Chattahoochee River corridor is extensive, and this area is readily avoidable for recreationalists. Therefore, the raw water pump station would have limited long-term visual impacts within the Chattahoochee River viewshed.

Reservoir Water Transmission System

The proposed reservoir water transmission system to carry reservoir water from White Creek to Lakeside WTP would be 31.5 miles and would run primarily along existing roadways (e.g. SR 23), and would be buried underground. However, a small portion of the system would cut through undeveloped areas, and would be visible where it would cross the Chattahoochee River southeast of the reservoir. The transmission river crossing would have no long-term impact to riparian scenery that could be visible to recreational users of the Chattahoochee River in the area, since it would be trenched under the river. The booster pump station would be located on an approximately 1-acre lot in an existing developed area outside of the visual resources identified for this project and therefore not considered to have a visual impact.

Roads

The visual resources potentially affected by the roads include the landscape lines, mixed hardwood forests, open fields, and rolling terrain associated with the White Creek watershed in the upland areas between the reservoir and the Chattahoochee River. New roadways would be constructed as a result of re-routing roads impounded by the proposed reservoir. The visual impacts due to new roadways are not considered adverse, since the roadways consist of a narrow footprint and are located in rural areas or rural residential areas with limited public viewshed. In addition, the construction of roadways in these rural areas would provide drivers the opportunity to experience this visual resource across previously inaccessible lands.

4.10.1.3 No Action Alternative

The No Action Alternative would keep the existing undeveloped areas intact, as well as the existing riparian scenery of both Flat Creek and White Creek in the immediate future. The current lands immediately surrounding Glades Reservoir are forested with an intended silviculture use; thus, the No Action Alternative would result in removal of extensive acreage of forest and cause a visual impact.

Both reservoir footprints are situated within high growth areas that will have continued residential and development pressure over time; with the No Action Alternative, these areas could be deforested and developed. Although Hall County has designated the Glades Reservoir area as Conservation on its future land use plan, the Gainesville/Hall County Comprehensive Plan (GHCCP)notes that there is continued development pressure on existing agricultural lands, as well as strong sentiment against protecting existing agricultural/forested land or preventing residential growth. Private development use of the land would adversely impact the aesthetic value of the land without the subsequent benefits of a reservoir as a scenic water feature.

The No Action Alternative would not add raw water transmission pipelines and pump stations, or reservoir water transmission lines. Therefore, the No Action Alternative would not add potential visual impact due to these types of water conveyances, nor short-term impacts associated with construction along these easements.

4.10.1.4 Unavoidable Adverse Impacts

Although the flooding of the proposed Glades and White Creek reservoirs would create irreversible scenic changes, there are no outstanding or unique scenic views, vegetation types, or public lands that would be altered within those areas. A raw water intake and pump station for pumping water from the Chattahoochee River to the reservoir would be added to currently natural riparian landscapes. Similarly, the reservoir transmission system for each alternative that would convey reservoir water to the Lakeside WTP would have an unavoidable pipeline crossing at the Chattahoochee River.

Table 4.76 provides an overview of visual/aesthetic impacts by reservoir component.

Table 4.76 Visual/Aesthetic Impact Summary

Alternative #	Alternative ID	Impacts to Visual Resources
Applicant	L18-G50-PT	Long-term limited impact of reservoir from perspective of nearby residences; small, long-term localized impact for recreationalists due to pump station at Chattahoochee River crossing; long-term impacts due to new roadways.
1	L18-G42-PT	Long-term limited impact of reservoir from perspective of nearby residences; small long-term localized impact for recreationalists due to pump station at Chattahoochee River crossing; long-term impacts due to new roadways.
2	L18-G42-PL	Long-term limited impact of reservoir from perspective of nearby residences; small, long-term localized impact for recreationalists due to pump station at Chattahoochee River; long-term impacts due to new roadways.
3	L18-G42-WTP	Long-term limited impact of reservoir from perspective of nearby residences; small, long-term localized impacts for recreationalists due to pump station at Chattahoochee River; long-term impact due to new WTP; long-term impacts due to new roadways
4	L30-G30-PT	Long-terrm limited impact from perspective of nearby residences; small, long-term localized impact for recreationalists due to pump station at Chattahoochee River crossing; long-term impacts due to new roadways
5	L30-G30-PL	Long-term limited impact from perspective of nearby residences; small, long-term localized impact for recreationalists due to pump station at Chattahoochee River; long-term limited impacts due to new roadways.
6	L30-G30-WTP	Long-term limited impact from perspective of nearby residences; small, long-term localized impact for recreationalists due to pump station at Chattahoochee River; long-term impact due to new WTP; limited impacts due to new roadways.
7	L43-G17-PT	Small, long-term localized impact of pump station at Chattahoochee River; limited long-term impact from perspective of nearby residences; limited impacts due to new roadways.
8	L43-G17-PL	Small, long-term localized impact for recreationalists of pump station at Chattahoochee River at Chattahoochee River; limited long-term impacts due to new roadways; limited impact from perspective of nearby residences
9	L43-G17-WTP	Small, long-term localized impact of pump station for recreationalists at Chattahoochee River; limited long-term impact from perspective of nearby residences; long-term impact due to new WTP; limited long-term impacts due to new roadways.
10	L43-W17-PT	Limited, long term impact from perspective of nearby residences; small, long-term localized impact of pump station for recreationalists at Chattahoochee River; limited long-term impacts due to new roadways.
11	L43-W17-PL	Limited, long-term impact from perspective of nearby residences; small, localized impact of pump station for recreationalists at Chattahoochee River; limited, long-termimpacts due to new roadways.
No Action	L60	No short-term impact. Property could convert private development with impacts to visual resources in the long-term.

4.11 Air Quality

4.11.1 Background

The air quality evaluation reviews how the project emissions affect ambient air quality. The Clean Air Act requires EPA to set National Ambient Air Quality Standards (NAAQS) (40 CFR part 50), set forth in Chapter 3. The State Implementation Plan (SIP) is the plan developed by the state to reduce air pollution to acceptable levels in the timeframe prescribed by the Clean Air Act. A SIP is developed in order to improve air quality in designated nonattainment and maintenance areas. A maintenance area classification requires conformity to transportation budgets for 20 years once the region is designated as attainment. Hall County is located as part of the region analyzed for Atlanta Regional Commission air quality conformity, while White, and Habersham counties are outside the areas covered in the SIP in Georgia, as documented by EPA (http://www.epa.gov/region4/air/sips/index.htm).

As mentioned in Chapter 3, Hall County was originally part of a geographic area that was designated as non-attainment for ozone. However, as of 2013, Hall County was removed from ozone non-attainment boundary and designated as part of a 20-county area, 8-hour ozone *maintenance* area. Hall County is designated as part of a 22-county non-attainment area for particulate matter fewer than 2.5 microns in diameter ($PM_{2.5}$) (http://www.epa.gov/airquality/greenbook/ancl.html). Hall County is *outside* the non-attainment areas for VOCs, NOx, CO, PM-10, SO_2, NO_2, and Pb.

4.11.2 Methodology

A federal action can be shown to 'conform' by demonstrating there will be no increase in emissions that will cause or contribute to violation of the NAAQS, and that the action conforms to the SIPAGE (http://www.epa.gov/oar/genconform/faq.html). Therefore, the Proposed Project has been evaluated against the *de minimis* thresholds as defined in 40 CFR 93 Section 153. These *de minimis* thresholds are the minimum levels used to determine conformity of various criteria pollutants in various areas. Federal actions are exempt from general conformity regulations if actions with emissions are clearly at or below *de minimis* levels (as outlined by the EPA in http://www.epa.gov/oar/genconform/faq.html). If the project is expected to emit more than the *de minimis* thresholds of any criteria pollutant in a year, for which the area is designated as a non-attainment or a maintenance arear, a more rigorous determination of conformity would be required. The *de minimis* thresholds are outlined in **Table 4.77**.

Table 4.77 *De minimis* Thresholds for Pollutants

Pollutant	Area Type	Tons/Year
Ozone (VOC or NO_x)	Serious nonattainment	50
	Severe nonattainment	25
	Extreme nonattainment	10
	Other areas outside an ozone transport region	100
Ozone (NO_x)	Marginal and moderate nonattainment inside an ozone transport region	100
	Maintenance	100
Ozone (VOC)	Marginal and moderate nonattainment inside an ozone transport region	50
	Maintenance within an ozone transport region	50
	Maintenance outside an ozone transport region	100
Carbon monoxide, SO_2 and NO_2	All nonattainment & maintenance	100
PM_{10}	Serious nonattainment	70
	Moderate nonattainment and maintenance	100
$PM_{2.5}$	All nonattainment & maintenance	100
Direct emissions, SO_2, NO_x (unless determined not to be a significant precursor), VOC or ammonia (if determined to be significant precursors)		
Lead (Pb)	All nonattainment & maintenance	25

Source: 40 CFR 93 Section 153

4.11.3 Project Air Emissions

Construction activities are the principal activities of the Proposed Project and alternatives that have the potential to result in air emissions. These activities will result in short-term adverse impacts. Emissions are associated with the types of construction equipment (e.g., non-road vehicles such as concrete truck, backhoe, dozer, cranes, pile drivers, etc.), the number of these vehicles being used, and the duration of the usage. Construction equipment usage ranges from 2 months to 36 months, depending on the phase of construction.

The construction activities for the following alternatives components are considered:

- Reservoirs (Glades or White Creek)
- River water transmission system (river to Glades Reservoir and White Creek Reservoir)
    - Raw water intake and pump station on the Chattahoochee River
    - Transmission main
- Reservoir water transmission system
    - Raw water intake and pump station at the reservoir
    - Transmission main to WTP
- WTP
    - New Glades WTP
    - Expansion of existing Lakeside intake and WTP

Project construction activities consist of varied durations and locations over multiple years. Construction of water supply components are spread over multiple decades based on the water supply needs. For example, the reservoir construction, pipeline construction, and pump station construction components

of the alternatives would all be implemented along different timelines. In essence, this phasing of the construction allows for impacts to be more distributed over time; therefore, avoiding exceedances of the *de minimis* thresholds on any given year.

The pollutant emissions calculations were based on assumptions on construction of the water supply components. Calculations included base assumptions on carpooling (i.e., 1.5 workers would arrive daily by per passenger truck). If the assumptions included more carpooling, then the emissions would decrease, and lead to lower annual emissions of NO_x or VOC. These calculations can be more refined as project construction activities are more fully developed. Project air emissions were calculated for these pollutants: carbon monoxide (CO), oxides of nitrogen (NOx), particulate matter fewer than 10 microns in diameter (PM_{10}), PM fewer than 2.5 microns in diameter ($PM_{2.5}$), sulfur dioxide (SO_2), and volatile organic compounds (VOCs). Total project emissions for CO, NO_x, PM_{10}, $PM_{2.5}$, SO_2, and VOCs, were calculated using construction assumptions about operations duration and emissions factors (i.e., 8 hour days over 40 hour weeks and 4 work weeks per month). Emissions factors were obtained from the EPA (*Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources,* EPA AP-42 Section 11.19.2, August 2004; and *Median Life, Annual Activity, and Load Factor Values for Nonroad Engine Emissions Modeling*, EPA-420-P-04-005, April 2004). The NOx and VOC are precursors to ozone, for which the county is in a maintenance area. The SO_2, NO_x, and VOCs are precursors to $PM_{2.5}$, for which the county is in non-attainment.

The emission of fugitive dust is also considered in the air quality evaluation. Fugitive dust has the potential to vary substantially over different phases of the construction process. Fugitive dust is atmospheric dust arising from mechanical disturbances, which is a common phenomenon as a result of heavy construction operations, similar to those that would occur with the construction of the reservoir, pump stations, and pipeline alternatives. Types of activities that could result in fugitive dust include demolition of buildings (which would be displaced if located within the reservoir footprints) and trees, drilling and blasting of soil, general land clearing, earth moving, etc. Typically, the concern is that the fugitive dust has the potential to drift and become a nuisance and could settle hundreds of feet from the source.

Table 4.78 provides a summary of the alternatives and projected equipment emissions (tons/year). For each alternative, total alternative emissions by pollutant based on source, years of construction activity leading to air emissions, and average emissions over the project years are provided to obtain a metric of tons/year. For the construction/expansion of a WTP, three expansions would be anticipated to reach the water demand in 2060; therefore, data are presented in terms of total emissions for each time the plant would be expanded. The data shown for WTP construction/expansion would apply to the Glades WTP or the Lakeside WTP, depending on alternative.

Table 4.78 Air Emissions of Construction Equipment

Applicant's Proposed Project						
Glades Reservoir 2021-2024						
Source	Total Emissions (tons)					
	CO	NO_X	PM_{10}	$PM_{2.5}$	SO_2	VOC
Total Alt Emissions	388.5	265.5	172.0	36.1	10.9	61.7
Project years	3.0	3.0	3.0	3.0	3.0	3.0
Average Emissions (tons/year)	129.5	88.5	57.3	12.0	3.6	20.6
Raw Water Transmission System 2038-2040						
Source	Total Emissions (tons)					
	CO	NO_X	PM_{10}	$PM_{2.5}$	SO_2	VOC
Total Alt Emissions	112.7	85.6	81.0	13.4	2.2	12.3
Project Years	1.2	1.2	1.2	1.2	1.2	1.2
Average Emissions (tons/year)	96.2	73.1	69.2	11.5	1.9	10.5
WTP (2034-2036, 2044-2046, 2054-2056)						
Source	Total Emissions (tons)					
	CO	NO_X	PM_{10}	$PM_{2.5}$	SO_2	VOC
Total Alt Emissions	41.3	1.7	45.0	6.1	1.8	0.0
Project Years	2.0	2.0	2.0	2.0	2.0	2.0
Average Emissions (tons/year)	20.6	0.9	22.5	3.0	0.9	0.0
Alternative 1						
Glades Reservoir 2021-2024						
Source	Total Emissions (tons)					
	CO	NO_X	PM_{10}	$PM_{2.5}$	SO_2	VOC
Total Alt Emissions	388.5	265.5	172.0	36.1	10.9	61.7
Project Years	3.0	3.0	3.0	3.0	3.0	3.0
Avgerage Emissions (tons/year)	129.5	88.5	57.3	12.0	3.6	20.6
Raw Water Transmission System 2038-2040						
Source	Total Emissions (tons)					
	CO	NO_X	PM_{10}	$PM_{2.5}$	SO_2	VOC
Total Alt Emissions	112.7	85.6	81.0	13.4	2.2	12.3
Project Years	1.2	1.2	1.2	1.2	1.2	1.2
Average Emissions (tons/year)	96.2	73.1	69.2	11.5	1.9	10.5
WTP (2034-2036, 2044-2046, 2054-2056)						
Source	Total Emissions (tons)					
	CO	NO_X	PM_{10}	$PM_{2.5}$	SO_2	VOC
Total Alt Emissions	41.3	1.7	45.0	6.1	1.8	0.0
Project Years	2.0	2.0	2.0	2.0	2.0	2.0
Average Emissions (tons/year)	20.6	0.9	22.5	3.0	0.9	0.0
Alternative 2						

Glades Reservoir 2021-2024						
Source	Total Emissions (tons)					
	CO	NO_X	PM_{10}	$PM_{2.5}$	SO_2	VOC
Total Alt Emissions	388.5	265.5	172.0	36.1	10.9	61.7
Project Years	3.0	3.0	3.0	3.0	3.0	3.0
Average Emissions (tons/year)	129.5	88.5	57.3	12.0	3.6	20.6
Raw Water Transmission System 2038-2040						
Source	Total Emissions (tons)					
	CO	NO_X	PM_{10}	$PM_{2.5}$	SO_2	VOC
Total Alt Emissions	107.5	85.2	81.0	13.4	1.8	12.3
Project Years	1.2	1.2	1.2	1.2	1.2	1.2
Average Emissions (tons/year)	91.7	72.7	69.1	11.4	1.5	10.5
Reservoir PS, Booster PS, Pipeline to Lakeside WTP 2022-2025						
Source	Total Emissions (tons)					
	CO	NO_X	PM_{10}	$PM_{2.5}$	SO_2	VOC
Total Alt Emissions	144.3	116.8	127.4	21.0	5.0	17.1
Project Years	1.7	1.7	1.7	1.7	1.7	1.7
Avgerage Emissions (tons/year)	87.3	70.6	77.0	12.7	3.0	10.4
WTP (2034-2036, 2044-2046, 2054-2056)						
Source	Total Emissions (tons)					
	CO	NO_X	PM_{10}	$PM_{2.5}$	SO_2	VOC
Total Alt Emissions	41.3	1.7	45.0	6.1	1.8	0.0
Project Years	2.0	2.0	2.0	2.0	2.0	2.0
Average Emissions (tons/year)	20.6	0.9	22.5	3.0	0.9	0.0

Alternative 3						
Glades Reservoir 2021-2024						
Source	Total Emissions (tons)					
	CO	NO_X	PM_{10}	$PM_{2.5}$	SO_2	VOC
Total Alt Emissions	388.5	265.5	172.0	36.1	10.9	61.7
Project Years	3.0	3.0	3.0	3.0	3.0	3.0
Average Emissions (tons/year)	129.5	88.5	57.3	12.0	3.6	20.6
WTP (2021-2026, 2031-2033, 2039-2041)						
Source	Total Emissions (tons)					
	CO	NO_X	PM_{10}	$PM_{2.5}$	SO_2	VOC
Total Alt Emissions	82.5	3.5	89.9	12.1	3.6	0.0
Project Years	3.0	3.0	3.0	3.0	3.0	3.0
Average Emissions (tons/year)	27.5	1.2	30.0	4.0	1.2	0.0
Raw Water Transmission System 2038-2040						
Source	Total Emissions (tons)					

Alternative 3						
	CO	NO_X	PM_{10}	$PM_{2.5}$	SO_2	VOC
Total Alt Emissions	107.5	85.2	40.8	10.9	1.8	12.3
Project Years	1.2	1.2	1.2	1.2	1.2	1.2
Average Emissions (tons/year)	91.7	72.7	34.8	9.3	1.5	10.5

Alternative 4						
Glades Reservoir 2021-2024						
Source	Total Emissions (tons)					
	CO	NO_X	PM_{10}	$PM_{2.5}$	SO_2	VOC
Total Alt Emissions	388.5	265.5	172.0	36.1	10.9	61.7
Project Years	3.0	3.0	3.0	3.0	3.0	3.0
Average Emissions (tons/year)	129.5	88.5	57.3	12.0	3.6	20.6
Raw Water Transmission System 2038-2040						
Source	Total Emissions (tons)					
	CO	NO_X	PM_{10}	$PM_{2.5}$	SO_2	VOC
Total Alt Emissions	112.7	85.6	81.0	13.4	2.2	12.3
Project Years	1.2	1.2	1.2	1.2	1.2	1.2
Average Emissions (tons/year)	96.2	73.1	69.2	11.5	1.9	10.5
WTP (2034-2036, 2044-2046, 2054-2056)						
Source	Total Emissions (tons)					
	CO	NO_X	PM_{10}	$PM_{2.5}$	SO_2	VOC
Construction Equipment Exhaust	30.0	0.9	0.0	0.0	0.9	0.0
Portable Diesel Engine Exhaust						
Onroad Exhaust						
Worker Commuting	11.3	0.8	0.0	0.0	0.9	0.0
Delivery Trucks						
Fugitive Dust						
Wind Erosion	-	-			-	-
Material Handling	-	-			-	-
Paved Roads	-	-	28.4	4.4	-	-
Unpaved Roads	-	-	16.6	1.7	-	-
Rock Crushing/Screening						
Total Alt Emissions	41.3	1.7	45.0	6.1	1.8	0.0
Project Years	2.0	2.0	2.0	2.0	2.0	2.0
Average Emissions (tons/year)	20.6	0.9	22.5	3.0	0.9	0.0

Alternative 5						
Glades Reservoir 2021-2024						
Source	Total Emissions (tons)					
	CO	NO_X	PM_{10}	$PM_{2.5}$	SO_2	VOC
Total Alt Emissions	388.5	265.5	172.0	36.1	10.9	61.7

Project Years	3.0	3.0	3.0	3.0	3.0	3.0
Average Emissions (tons/year)	129.5	88.5	57.3	12.0	3.6	20.6
Raw Water Transmission System 2038-2040						
Source	Total Emissions (tons)					
	CO	NO_X	PM_{10}	$PM_{2.5}$	SO_2	VOC
Total Alt Emissions	107.5	85.2	81.0	13.4	1.8	12.3
Project Years	1.2	1.2	1.2	1.2	1.2	1.2
Average Emissions (tons/year)	91.7	72.7	69.1	11.4	1.5	10.5
Reservoir PS, Booster PS, Pipeline to Lakeside WTP 2022-2025						
Source	Total Emissions (tons)					
	CO	NO_X	PM_{10}	$PM_{2.5}$	SO_2	VOC
Total Alt Emissions	144.3	116.8	127.4	21.0	5.0	17.1
Project Years	1.7	1.7	1.7	1.7	1.7	1.7
Average Emissions (tons/year)	87.3	70.6	77.0	12.7	3.0	10.4
WTP (2034-2036, 2044-2046, 2054-2056)						
Source	Total Emissions (tons)					
	CO	NO_X	PM_{10}	$PM_{2.5}$	SO_2	VOC
Total Alt Emissions	41.3	1.7	45.0	6.1	1.8	0.0
Project Years	2.0	2.0	2.0	2.0	2.0	2.0
Average Emissions (tons/year)	20.6	0.9	22.5	3.0	0.9	0.0
Alternative 6						
Glades Reservoir 2021-2024						
Source	Total Emissions (tons)					
	CO	NO_X	PM_{10}	$PM_{2.5}$	SO_2	VOC
Total Alt Emissions	388.5	265.5	172.0	36.1	10.9	61.7
Project Years	3.0	3.0	3.0	3.0	3.0	3.0
Average Emissions (tons/year)	129.5	88.5	57.3	12.0	3.6	20.6
WTP (2021-2026, 2031-2033, 2039-2041)						
Source	Total Emissions (tons)					
	CO	NO_X	PM_{10}	$PM_{2.5}$	SO_2	VOC
Total Alt Emissions	82.5	3.5	89.9	12.1	3.6	0.0
Project Years	3.0	3.0	3.0	3.0	3.0	3.0
Average Emissions (tons/year)	27.5	1.2	30.0	4.0	1.2	0.0
Raw Water Transmission System 2038-2040						
Source	Total Emissions (tons)					
	CO	NO_X	PM_{10}	$PM_{2.5}$	SO_2	VOC
Total Alt Emissions	107.5	85.2	40.8	10.9	1.8	12.3
Project Years	1.2	1.2	1.2	1.2	1.2	1.2
Average Emissions (tons/year)	91.7	72.7	34.8	9.3	1.5	10.5
Alternative 7						

Glades Reservoir 2021-2024						
Source	Total Emissions (tons)					
	CO	NO_X	PM_{10}	$PM_{2.5}$	SO_2	VOC
Total Alt Emissions	388.5	265.5	172.0	36.1	10.9	61.7
Project Years	3.0	3.0	3.0	3.0	3.0	3.0
Average Emissions (tons/year)	129.5	88.5	57.3	12.0	3.6	20.6
Raw Water Transmission System 2038-2040						
Source	Total Emissions (tons)					
	CO	NO_X	PM_{10}	$PM_{2.5}$	SO_2	VOC
Total Alt Emissions	112.7	85.6	81.0	13.4	2.2	12.3
Project Years	1.2	1.2	1.2	1.2	1.2	1.2
Average Emissions (tons/year)	96.2	73.1	69.2	11.5	1.9	10.5
WTP (2034-2036, 2044-2046, 2054-2056)						
Source	Total Emissions (tons)					
	CO	NO_X	PM_{10}	$PM_{2.5}$	SO_2	VOC
Total Alt Emissions	41.3	1.7	45.0	6.1	1.8	0.0
Project Years	2.0	2.0	2.0	2.0	2.0	2.0
Average Emissions (tons/year)	20.6	0.9	22.5	3.0	0.9	0.0
Alternative 8						
Glades Reservoir 2021-2024						
Source	Total Emissions (tons)					
	CO	NO_X	PM_{10}	$PM_{2.5}$	SO_2	VOC
Total Alt Emissions	388.5	265.5	172.0	36.1	10.9	61.7
Project Years	3.0	3.0	3.0	3.0	3.0	3.0
Average Emissions (tons/year)	129.5	88.5	57.3	12.0	3.6	20.6
Raw Water Transmission System 2038-2040						
Source	Total Emissions (tons)					
	CO	NO_X	PM_{10}	$PM_{2.5}$	SO_2	VOC
Total Alt Emissions	107.5	85.2	81.0	13.4	1.8	12.3
Project Years	1.2	1.2	1.2	1.2	1.2	1.2
Average Emissions (tons/year)	91.7	72.7	69.1	11.4	1.5	10.5
Reservoir PS, Booster PS, Pipeline to Lakeside WTP 2022-2025						
Source	Total Emissions (tons)					
	CO	NO_X	PM_{10}	$PM_{2.5}$	SO_2	VOC
Total Alt Emissions	144.3	116.8	127.4	21.0	5.0	17.1
Project Years	1.7	1.7	1.7	1.7	1.7	1.7
Average Emissions (tons/year)	87.3	70.6	77.0	12.7	3.0	10.4
WTP (2034-2036, 2044-2046, 2054-2056)						
Source	Total Emissions (tons)					
	CO	NO_X	PM_{10}	$PM_{2.5}$	SO_2	VOC

Total Alt Emissions	41.3	1.7	45.0	6.1	1.8	0.0
Project Years	2.0	2.0	2.0	2.0	2.0	2.0
Average Emissions (tons/year)	20.6	0.9	22.5	3.0	0.9	0.0

Alternative 9

Glades Reservoir 2021-2024

Source	Total Emissions (tons)					
	CO	NO_X	PM_{10}	$PM_{2.5}$	SO_2	VOC
Total Alt Emissions	388.5	265.5	172.0	36.1	10.9	61.7
Project Years	3.0	3.0	3.0	3.0	3.0	3.0
Average Emissions (tons/year)	129.5	88.5	57.3	12.0	3.6	20.6

WTP (2021-2026, 2031-2033, 2039-2041)

Source	Total Emissions (tons)					
	CO	NO_X	PM_{10}	$PM_{2.5}$	SO_2	VOC
Total Alt Emissions	82.5	3.5	89.9	12.1	3.6	0.0
Project Years	3.0	3.0	3.0	3.0	3.0	3.0
Average Emissions (tons/year)	27.5	1.2	30.0	4.0	1.2	0.0

Raw Water Transmission System 2038-2040

Source	Total Emissions (tons)					
	CO	NO_X	PM_{10}	$PM_{2.5}$	SO_2	VOC
Total Alt Emissions	107.5	85.2	40.8	10.9	1.8	12.3
Project Years	1.2	1.2	1.2	1.2	1.2	1.2
Average Emissions (tons/year)	91.7	72.7	34.8	9.3	1.5	10.5

Alternative 10

White Creek Reservoir 2046-2050

Source	Total Emissions (tons)					
	CO	NO_X	PM_{10}	$PM_{2.5}$	SO_2	VOC
Total Alt Emissions	402.8	277.1	172.7	36.7	11.1	63.3
Project Years	3.0	3.0	3.0	3.0	3.0	3.0
Average Emissions (tons/year)	134.3	92.4	57.6	12.2	3.7	21.1

Raw Water Transmission System 2048-2050

Source	Total Emissions (tons)					
	CO	NO_X	PM_{10}	$PM_{2.5}$	SO_2	VOC
Total Alt Emissions	112.7	85.6	77.1	12.9	2.2	12.3
Project Years	1.2	1.2	1.2	1.2	1.2	1.2
Average Emissions (tons/year)	96.2	73.1	65.8	11.0	1.9	10.5

WTP (2034-2036, 2044-2046, 2054-2056)

Source	Total Emissions (tons)					
	CO	NO_X	PM_{10}	$PM_{2.5}$	SO_2	VOC
Total Alt Emissions	41.3	1.7	45.0	6.1	1.8	0.0
Project Years	2.0	2.0	2.0	2.0	2.0	2.0

Average Emissions (tons/year)	20.6	0.9	22.5	3.0	0.9	0.0
Alternative 11						
White Creek Reservoir 2046-2050						
Source	Total Emissions (tons)					
	CO	NO_X	PM_{10}	$PM_{2.5}$	SO_2	VOC
Total Alt Emissions	402.8	277.1	172.7	36.7	11.1	63.3
Project Years	3.0	3.0	3.0	3.0	3.0	3.0
Average Emissions (tons/year)	134.3	92.4	57.6	12.2	3.7	21.1
Raw Water Transmission System 2048-2050						
Source	Total Emissions (tons)					
	CO	NO_X	PM_{10}	$PM_{2.5}$	SO_2	VOC
Total Alt Emissions	112.7	85.6	49.8	10.1	2.2	12.3
Project Years	1.2	1.2	1.2	1.2	1.2	1.2
Average Emissions (tons/year)	96.2	73.1	42.5	8.6	1.9	10.5
Reservoir PS, Booster PS, Pipeline to Lakeside WTP 2046-2050						
Source	Total Emissions (tons)					
	CO	NO_X	PM_{10}	$PM_{2.5}$	SO_2	VOC
Total Alt Emissions	205.4	164.7	130.0	28.0	16.0	24.8
Project Years	1.7	1.7	1.7	1.7	1.7	1.7
Average Emissions (tons/year)	124.2	99.6	78.6	16.9	9.7	15.0
WTP (2034-2036, 2044-2046, 2054-2056)						
Source	Total Emissions (tons)					
	CO	NO_X	PM_{10}	$PM_{2.5}$	SO_2	VOC
Total Alt Emissions	41.3	1.7	45.0	6.1	1.8	0.0
Project Years	2.0	2.0	2.0	2.0	2.0	2.0
Average Emissions (tons/year)	20.6	0.9	22.5	3.0	0.9	0.0

4.11.4 Results

Based on the construction sequence presented in Chapter 2, the estimated emissions from construction of the majority of water supply infrastructure components would be below the *de minimis* levels and are considered within air quality conformity. **Table 4.78** above shows that none of the alternatives would exceed *de minimis* thresholds in any given year for $PM_{2.5}$, the pollutant for which Hall County is in non-attainment.

The operational effects of the project to air quality are expected to be below applicable air quality standards for all pollutants in **Table 4.78**. Short-term adverse contributions to emissions from maintenance vehicles and visitor vehicles are anticipated.

All alternatives consist of construction activities that could result in fugitive dust.

No Action Alternative

The No Action Alternative has no project that would be implemented and no air quality impacts would occur.

4.11.5 Mitigation and Monitoring

Table 4.78 above shows that some mitigation techniques may be recommended for certain types of emissions (e.g. including precursors to ozone, such as NOx and VOC and the prercursors to $PM_{2.5}$ such as SO_2, NOx, and VOC), although the project would conform to *de minimis* levels outlined above for $PM_{2.5}$, for which Hall County is in nonattainment. As noted above, the highest potential for emissions exceedances would occur with the construction of the Glades Reservoir and White Creek Reservoir. Emissions can be affected by weather conditions, implementation of longer work days (especially during longer day light hours), increased worker commuting options, extension of construction time over more years, more efficient equipment such as later model dump trucks and haulers with diesel particulate filters, and equipment inspection and maintenance programs. A plan to minimize emissions from heavy-duty non-road equipment (e.g., dozers, concrete mixers, etc. as indicated above) may be required to identify the potential and minimize emissions of NOx, VOC, and $PM_{2.5}$. Control Technologies can be implemented to mitigate rock crusher emissions, for example. The EPA technology transfer network provides available control technologies, prevention options and control technology decisions that can be used to minimize criteria pollutant emissions.

Mitigation to reduce the potential for fugitive dust would be implemented in several ways. All persons and tasks associated with project implementation that may result in fugitive dust shall take all reasonable precautions to prevent such dust from becoming airborne. Some reasonable precautions that could be taken to prevent dust from becoming airborne include (WRAP Fugitive Dust Handbook, 2006), but are not limited to, the following:

- Use, where possible, of water to control of dust in the demolition, construction operations, the grading of roads or the clearing of land
- Limit on-site vehicle speed to 15 mph
- Prohibit activities during high winds
- Application of asphalt, oil, water, or suitable chemicals on dirt roads, materials, stockpiles, and other surfaces which can give rise to airborne dusts
- Covering at all times when in motion, open bodied trucks, transporting materials likely to give rise to airborne dusts
- Enclose rock crushing equipment and vent to a Baghouse

Taking these or similar precautions will reduce the potential for fugitive dust to create air emissions as a result of construction activities.

Table 4.79 below summarizes the air quality impacts by alternative.

Table 4.79 – Summary of All Alternatives- Air Quality Impacts

Alternative #	Alternative ID	Air Quality Impacts
Applicant	L18-G50-PT	In conformity for $PM_{2.5}$.
1	L18-G42-PT	In conformity for $PM_{2.5}$.
2	L18-G42-PL	In conformity for $PM_{2.5}$.
3	L18-G42-WTP	In conformity for $PM_{2.5}$.
4	L30-G30-PT	In conformity for $PM_{2.5}$.
5	L30-G30-PL	In conformity for $PM_{2.5}$.
6	L30-G30-WTP	In conformity for $PM_{2.5}$.
7	L43-G17-PT	In conformity for $PM_{2.5}$.
8	L43-G17-PL	In conformity for $PM_{2.5}$.
9	L43-G17-WTP	In conformity for $PM_{2.5}$.
10	L43-W17-PT	In conformity for $PM_{2.5}$.
11	L43-W17-PL	In conformity for $PM_{2.5}$.
No Action	L60	In conformity. No impacts.

4.12 Noise

4.12.1 Reservoir and Dam (All Reservoir Alternatives)

4.12.1.1 Construction

Construction of the dam and clearing of the reservoir area would have short-term noise effects, primarily due to noise from tree clearing activities, the use of cranes and concrete trucks, mud pumps, diesel generators, and heavy construction vehicles during the construction of the dam. Individual pieces of construction equipment (e.g. air compressors, backhoes, jack hammers, pavers, etc.) typically generate noise levels of 80 to 90 A-weighted decibels (dBA) at a distance of 50 feet (**Table 4.80**).

With multiple items of equipment operating concurrently, noise levels can be relatively high during daytime periods within several hundred feet of active construction sites. The zone of relatively high construction noise levels typically extends to distances of 400 to 800 feet from the site of major equipment operations. According to sound wave mechanics, sound levels drop 6 dB when distance is doubled. Additionally, a 200-foot width of dense vegetation can reduce noise by 10 decibels, which cuts in half the loudness of traffic noise (*Highway Traffic Noise*, U.S. Department of Transportation, Federal Highway Association (FHWA), September 1980, as reprinted in http://www.nonoise.org/library/highway/traffic/traffic.htm, accessed May 20, 2015). Locations (i.e., noise sensitive receptors) more than 800 feet from construction sites seldom experience noticeable levels of construction noise.

Table 4.80 Noise Levels Associated with Outdoor Construction

Construction Phase	dBA L_{eq} at 50 feet from Source
Ground Clearing	84
Excavation, Grading	89
Foundations	78
Structural	85
Finishing	89

Notes:
EPA, 1974. Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety.
dBA = A-weighted decibel
L_{eq} = equivalent sound level

Primary activities associated with the reservoir and dam completion consist of tree clearing and dam construction. Clearing of trees within the reservoir footprint would result in temporary, short term noise impacts due to machinery and only affect structures located along the fringes of the reservoir footprint. Alternatively, the dam construction activities are anticipated to last approximately three years and have potential to result in adverse noise impacts. Despite the potential for dam construction activities to result in noise impacts, no receptors (i.e., residences) are located within 800 feet of the Glades Reservoir dam or the White Creek Reservoir dam. The closest residence to the White Creek Reservoir dam is located 1400 feet from the dam off Ashley Drive, and the closest residence to the Glades Reservoir dam is located over 2,000 feet from the dam off Glade Farm Road. Both residences are outside the zone of impact of the dam construction activities In addition, a dense vegetation buffer of at least 200 feet, which is likely to dampen sound effects due to construction noise associated with dams, is just beyond the dam construction sites for both Glades Reservoir and White Creek Reservoir.. Therefore , limited impacts due to construction noise are anticipated as a result of project implementation.

The Chattahoochee River is located more than 1400 feet from the proposed dam at White Creek Reservoir and more than 2000 feet from the proposed dam at Glades Reservoir; therefore, noise impacts due to construction activities would be negligible to paddlers, boaters, or fisherman using the Chattahoochee River.

Given the temporary nature of proposed construction activities, these effects would be short-term.

4.12.1.2 Operations

There are no sources of noise associated with function of the proposed reservoir and dam; therefore, its operation would have negligible effects to the existing noise environment. Upon the final acquisition of land most existing sources of noise within the reservoir footprint such as agricultural activities, automobile traffic, and lawn maintenance equipment would end. This return to natural quiet and absence of manmade noise would be considered a long-term beneficial impact. Motor boats or vehicles

would not be permitted on the reservoirs or associated trails; therefore, no noise impacts would occur as a result of the recreational component of the construction of the reservoirs.

4.12.2 River Water Transmission Systems (All Reservoir Alternatives)

4.12.2.1 Construction

Both the Glades river water transmission system and the White Creek river water transmission system would take approximately 1.1 years to construct. Construction of the transmission system would have short-term effects on the noise environment, primarily due to noise from heavy construction equipment and vehicles used during the construction of the pipeline. The noise would be similar in nature to the heavy equipment noise described above for the dam and reservoir, though on a smaller scale. Heavy equipment and subsequent noise would not be fixed in one location, but would progress along the pipeline as construction progressed. Therefore, construction noise would be temporary and would subside at any particular location as activities progressed. There are some nearby residents who may experience temporary construction noise.

The Glades raw water pump station would take 1.2 years to construct, and the White Creek raw water pump station would take 1.5 years to construct. As stated previously, the zone of relatively high construction noise levels typically extends to distances of 400 to 800 feet from the site of major equipment operations. There are no residences within 800 feet of the Glades Reservoir raw water pump station, thus no noise impacts associated with this component. There are nine residences within 800 feet of the White Creek Reservoir pump station, resulting in short-term noise impacts on local residents in this area. The nearest residence to the White Creek Reservoir pump station is approximately 225 feet away. This residence would be more likely to experience noise impacts as a result of the pump station construction.

4.12.2.2 Operations

Operation of pump stations in the river water transmission system would have long-term noise effects. All equipment would be enclosed at the pump stations, but some mechanical noise may be audible at close range. Some noise due to the use of backup generators may be present during power outages and as a result of the pumping activities. As stated above, there are no noise impacts associated with the Glades Reservoir raw water pump station given lack of adjacent population, but and nine residences are located within 800 feet of the White Creek Reservoir pump station, resulting in long-term impacts on these local residents. The nearest residence to the White Creek Reservoir pump station, approximately 225 feet away, would be more likely to experience noise impacts from the pump station operation. . At a distance of approximately 200 feet from a pump source, the noise level would be 63 dBA. Normal conversation has a dBA of 60 and the outside noise level for residences is 66 dBA. Noise from the pump stations is expected to decrease to less than 50 dBA within several hundred feet of each station. Pump station noise impacts would be intermittent and temporary, lasting only as long as the pumping occurs.

4.12.3 Reservoir Transmission Systems (All Reservoir Alternatives)

4.12.3.1 Construction

Both the Glades Reservoir water transmission system and the White Creek Reservoir water transmission system would take approximately 1.5 years to construct. Construction of the transmission system would have short-term noise effects, primarily due to noise from heavy construction equipment and vehicles used during the construction of the pipeline. The noise would be similar in nature to the heavy equipment noise described previously for the dam and reservoir, though on a smaller scale. Heavy equipment would not be fixed in one location, but would progress along the pipeline as construction progressed. Therefore, construction noise would be temporary and would subside at any particular location as activities progressed. There are some nearby residents who may experience temporary construction noise.

4.12.3.2 Operations

Reservoir water transmission system operations would have long-term noise effects due to the pump station located at the reservoir and the booster pump station in both Glades Reservoir and White Creek Reservoir alternatives. There are no residences within 800 feet of the Glades Reservoir pump station and no residences within 800 feet of the White Creek Reservoir pump station, resulting in no effects on local residents at either location. As mentioned above, noise from pump stations is expected to decrease to less than 50 dBA over several hundred feet from the source. The booster pump station location is provided in a general vicinity; however, the actual site selection would be considered to reduce noise to communities, and would likely be closer to existing industrial infrastructure, such as the Lee Gilmer Airport in Gainesville. All equipment would be enclosed at the pumping stations, but some mechanical noise may be audible at close range. Some noise due to the use of backup generators may be present during power outages and as a result of pumping activities. These events would be intermittent, and temporary in nature, lasting only as long as pumping occurs.

4.12.4 Water Treatment Plant

4.12.4.1 Construction

Construction of the new WTP for Glades Reservoir alternatives would have short-term, temporary noise effects, given the temporary nature of proposed construction activities. As noted previously, individual pieces of construction equipment typically generate noise levels of 80 to 90 dBA at a distance of 50 feet (**Table 4.80**).

Construction noise would dominate the soundscape for all on-site personnel. Construction personnel, and particularly equipment operators, would wear adequate personal hearing protection to limit exposure and ensure compliance with federal health and safety regulations.

4.12.4.2 Operations

There are no appreciable sources of noise associated with the operation of the proposed WTP.

4.12.5 Local Re-routed Roads

4.12.5.1 Construction

Construction of the new local roads and bridge would have a short-term, temporary noise effect, given the temporary nature of proposed construction activities. As noted previously, individual pieces of construction equipment typically generate noise levels of 80 to 90 A-weighted dBA at a distance of 50 feet (**Table 4.80**), these effects would be minor.

4.12.5.2 Operations

For each new road associated with Glades Reservoir, and the majority of the White Creek Reservoir new roads, construction will occur in currently undeveloped areas. According to USDOT (1980), traffic noise depends on the volume of traffic, the speed of traffic, and the number of trucks in the traffic flow. Each of the new roads will be local roads, where traffic volumes are currerntly low under existing conditions. It is anticipated that noise levels would occur on the new location roads, resulting in long-term noise effects. As mentioned under the dam construction section above, many of the areas in Glades Reservoir and White Creek Reservoir are currently forested, and 200 feet of vegetation results in a noise reduction of 10 decibels. Additionally, terrain is also a variable that can affect sound travel. There is extensive topographic terrain associated with both the Glades Reservoir and White Creek Reservoir sites, which is anticipated to dampen noise resulting from new location roads.

4.12.6 Potential Mitigation

The following best management practices to mitigate construction-related noise may be used to reduce further any realized noise impacts:

- contract specifications that consider modified construction hours in areas adjacent to noise sensitive land uses such as residential and recreational areas
- construction equipment mufflers to be properly maintained and in good working order
- dampening and shielding of vibration or hydraulic equipment
- baffles on compressors, use of electric compressors
- bubble curtain in aquatic areas to minimize aquatic vibrations
- blast mats

Noise from construction is unavoidable, but short-term and not predicted to be significant in the areas of the dam construction due to the lack of residences within 800 feet of this area. However, in more populated areas, noise mitigation techniques may be considered based on the noise receptors located in the immediate surroundings. Re-routed roads would result in traffic noise in areas previously not exposed to traffic noise. However, due to the low volumes that the existing roads currently carry, only very slight increases in noise are anticipated for local road relocations.

Site selection of the reservoirs and the pump station locations has been conducted to minimize impacts to populated areas. Site selection of the booster pump station location will be finalized to minimize noise impacts to neighborhoods and local residences.

4.12.7 No Action Alternative

The No Action Alternative would have no impacts to noise because there would be no installation of the dam, WTP, or pipeline. Noise levels would remain unchanged when compared to existing conditions described in Section 3.11.

Table 4.81 below provides a summary of noise impacts for all alternatives.

Table 4.81 Summary of All Alternatives- Noise Impacts

Alternative #	Alternative ID	Noise Impacts
Applicant	L18-G50-PT	Short-term adverse impacts due to clearing, and construction of pump station, and river water transmission main.
1	L18-G42-PT	Short-term adverse impacts due to clearing, and construction of pump station and river water transmission main. No impacts due to dam construction and no impacts due to pump station operations.
2	L18-G42-PL	Short-term adverse impacts due to clearing, and construction of pump stations, and river and reservoir water transmission mains. No impacts due to dam construction and no impacts due to pump station operations at river and at reservoir.
3	L18-G42-WTP	Short-term adverse impacts due to clearing, and construction of pump stations, river water transmission main, and new WTP. No impacts due to dam construction and no operational impacts due to pump station operations at river and at reservoir.
4	L30-G30-PT	Short-term adverse impacts due to clearing, and construction of pump station and river water transmission main. No impacts due to dam and no impacts due to pump station operations.
5	L30-G30-PL	Short-term adverse impacts due to clearing, and construction of pump stations, and river and reservoir water transmission mains. No impacts due to dam and no impacts due to pump station operations at river and at reservoir.
6	L30-G30-WTP	Short-term adverse impacts due to clearing, and construction of pump stations, river water transmission main, and new WTP. No impacts due to dam construction and no operational impacts due to pump station operations at river and at reservoir.
7	L43-G17-PT	Short-term adverse impacts due to clearing, and construction of pump station and river water transmission main. No impacts due to dam and no impacts due to pump station operations.
8	L43-G17-PL	Short-term adverse impacts due to clearing, and construction of pump stations, and river and reservoir water transmission mains. No impacts due to dam and no impacts due to pump station operations at river and at reservoir.
9	L43-G17-WTP	Short-term adverse impacts due to clearing, and construction of pump stations, river water transmission main, and new WTP. No impacts due to dam construction and no operational impacts due to pump station operations at river and at reservoir.
10	L43-W17-PT	Short-term adverse impacts due to clearing, and construction of pump station, and river water transmission main. No impacts due to dam construction or reservoir pump station. Long-term minor impacts due to pump station operations at Chattahoochee River (9 residences).
11	L43-W17-PL	Short-term adverse impacts due to clearing, and construction of pump stations, and river and reservoir water transmission main. No impacts due to dam construction or reservoir pump station. Long-term adverse impacts due to pump station operations at Chattahoochee River (9 residences).
No Action	L60	None

4.13 Cultural Resources

4.13.1 Summary Impacts for All Reservoir Alternatives

Cultural resources include historic properties, prehistoric archaeological sites and historic archaeological sites, as well as the remains of domestic, industrial, or commercial activities located within the area of potential effect (APE).

The Proposed Project and alternatives include the following three APEs:

- Glades Reservoir
- White Creek Reservoir
- Glades and White Creek River and Reservoir Transmission Systems

Table 4.82 lists the cultural resources that would be impacted by each alternative.

Table 4.82 Cultural Resources Impacted by Alternatives

Alternative #	Alternative ID	Historic Resources Adverse Effects	Archaeological Direct Impacts (Recommendations)
Applicant	L18-G50-PT	Glade Farm House; Mose Gordon Lumber Co. Mess Hall	Phase II[1] – 2 potentially eligible sites; Deep Testing[2] – 4 sites
1	L18-G42-PT	Glade Farm House; Mose Gordon Lumber Co. Mess Hall	Phase II – 2 potentially eligible sites; Deep Testing – 4 sites
2	L18-G42-PL	Glade Farm House; Mose Gordon Lumber Co. Mess Hall; 7 historic sites with unknown eligibility	Phase II – 2 potentially eligible sites; Deep Testing – 4 sites; 1 site unknown eligibility
3	L18-G42-WTP	Glade Farm House; Mose Gordon Lumber Co. Mess Hall	Phase II – 2 potentially eligible sites; Deep Testing – 4 sites
4	L30-G30-PT	Glade Farm House; Mose Gordon Lumber Co. Mess Hall	Phase II – 2 potentially eligible sites; Deep Testing – 4 sites
5	L30-G30-PL	Glade Farm House; Mose Gordon Lumber Co. Mess Hall; 7 historic sites with unknown eligibility	Phase II – 2 potentially eligible sites; Deep Testing – 4 sites; 1 site unknown eligibility
6	L30-G30-WTP	Glade Farm House; Mose Gordon Lumber Co. Mess Hall	Phase II- 2 potentially eligible sites; Deep Testing – 4 sites
7	L43-G17-PT	Glade Farm House; Mose Gordon Lumber Co. Mess Hall	Phase II- 2 potentially eligible sites; Deep Testing – 4 sites
8	L43-G17-PL	Glade Farm House; Mose Gordon Lumber Co. Mess Hall; 7 historic sites with unknown eligibility	Phase II- 2 potentially eligible sites; Deep Testing – 4 sites; 1 site unknown eligibility
9	L43-G17-WTP	Glade Farm House; Mose Gordon Lumber Co. Mess Hall	Phase II – 2 potentially eligible sites; Deep Testing – 4 sites
10	L43-W17-PT	None	None
11	L43-W17-PL	7 historic sites with unknown eligibility	1 site unknown eligibility
No Action	L60	None	None

[1] Phase II testing - additional testing used to make formal determinations of eligibility,
[2] Deep testing - trenching/stripping of the historic overburden in the archaeologically sensitive areas

4.13.2 Mitigation and Monitoring

4.13.2.1 Glades Reservoir APE

A draft determination of effect, programmatic agreement, and memorandum of agreement are currently being coordinated with the State Historic Preservation Office (SHPO) under Section 106 of the National Historic Preservation Act (NHPA) for the Glades Reservoir alternatives. The APE of these documents consists of the reservoir APE as described in Chapter 3. The agreement outlines the mitigation for adverse effects for the Glade Farm historic site and Mose Gordon Lumber Company Mess Hall Building. The impact to these historic resources will be mitigated primarily through archival documentation. This will include the preparation of archival quality aerial and landscape photographs, maps illustrating the historical property, and brief narrative histories for each of the NRHP-eligible sites (see **Appendix T**).

In addition to the historic sites, the programmatic agreement addresses the two prehistoric archaeological sites and four buried sites that were identified during field surveys. Prehistoric archaeological sites 9HL462 and 9HL478 are potentially eligible for the NRHP, and require additional archaeological Phase II testing in order to determine whether they are eligible for inclusion under NRHP. Sites IF-1, IF-3, IF-11, and IF-13 are archaeologically sensitive with high potential for buried prehistoric deposits at the locations of isolated artifact finds. Deep testing (i.e., trenching/stripping of the historic overburden in the archaeologically sensitive areas) is recommended to determine the NRHP eligibility of these four archaeological sensitive findings.

4.13.2.2 White Creek Reservoir APE

Research was conducted using Georgia's Natural, Archaeological, and Historic Resources GIS (GNAHRGIS) and the Georgia Archaeological Site File (GASF) to determine whether any NRHP-listed or eligible sites were located within the area. These reviews indicated that no known archaeological resources are located within the White Creek Reservoir APE. As such, no mitigation or monitoring is proposed.

4.13.2.3 Glades and White Creek River and Raw Water Transmission Systems APEs

Since the previously identified archaeological resource with unknown eligibility would not be adversely impacted by the Proposed Project, mitigation measures have not been recommended.

4.13.3 Unavoidable Adverse Impacts

4.13.3.1 Glades Reservoir APE

No physical impacts would occur to historic structures found within the Glades Reservoir alternatives; however, unavoidable adverse impacts to the viewsheds of the NRHP-eligible Glade Farm House and the NRHP-eligible Mose Gordon Lumber Co. Mess Hall would result from project implementation and would be mitigated through archival documentation as described above. Additionally, a map demarcating the NRHP boundary limits of Glade Farm (including agricultural fields, wooded areas, pastures and Glade Farmhouse) and a brief narrative history shall be prepared to supplement aerial and landscape photographs as part of the archival documentation (see Draft Programmatic Agreement, **Appendix T**).

Deep testing is recommended at four buried sites identified during field surveys as archaeologically sensitive with high potential for buried prehistoric deposits at the locations of isolated artifact finds(IF-1, IF-3, IF-11, and IF-13). Phase II testing, additional testing used to make formal determinations of eligibility, is recommended for two potentially NRHP-eligible sites, including 9HL462 and 9HL478, which are archaeological finds determined to have unknown eligibilities. Upon additional investigation of archaeological sites identified for Phase II testing and deep testing, any unavoidable adverse impacts would be identified. Should NRHP-eligible sites be found, mitigation measures would be proposed.

4.13.3.2 White Creek Reservoir APE

No NRHP-eligible historic structures have been identified within the White Creek Reservoir APE; therefore, no unavoidable adverse impacts would occur. Upon additional investigation of archaeological and historic sites through field survey, if NRHP-eligible or listed sites are identified and unavoidable adverse impacts would occur, then mitigation would be proposed.

Glades and White Creek River and Raw Water Transmission Systems APE

No NRHP-eligible or listed historic structures or archaeological sites have been identified within the transmission systems APE; therefore, no unavoidable adverse impacts would occur. The seven historic sites with unknown eligibility are located in areas where there would be construction of buried transmission main within previously disturbed road ROW. These construction activities would be limited to 50 feet, including 30 feet of permanent impact and 20 feet of easement for access to buried pipeline. Due to the limited area of impact required for the transmission main construction, there would be no adverse impacts to any of the historic structures identified with unknown eligibility.

Three historic sites with unknown eligibility are cemeteries. Any work being conducted in the vicinity of cemeteries will be conducted outside the boundary of the cemeteries. If any graves or artifacts are identified during construction activities, then work will be stopped and coordination with the site supervisor will occur to ensure no impacts to graves sites would occur.

One previously recorded prehistoric site with unknown NRHP eligibility was identified based on GNAHRGIS, GASF, and Georgia SHPO files. Site 9HL445 is located at the southernmost portion of the transmission system, and is a highly disturbed prehistoric lithic scatter located on a ridge nose in Hall County. The highly disturbed archaeological site would not be adversely impacted by the Proposed Project. Given the nature of project implementation in this area and the type of archaeological site, minimal additional disturbance within previously disturbed ROW would occur and no adverse impacts are anticipated.

4.14 Hazardous Materials

4.14.1 Glades Reservoir

4.14.1.1 River Water Transmission System

No hazardous waste or hazardous materials facilities and no known hazardous waste sites were identified within the 500-foot online search radius of the footprint of the raw water transmission main,

intake, and pump station that will travel from the Chattahoochee River to the Glades Reservoir. The closest Resource Conservation Recovery Act of 1976 (RCRA) site is the Georgia Power Company (GPC)– Hulsey Lane facility located approximately 2.25 miles southwest of the transmission lines. No structures were noted within the footprint of the raw water transmission main, intake, and pump station; therefore, asbestos-containing material (ACM), lead-based paint, and polychlorinated biphenyls (PCBs) are not likely present.

4.14.1.2 Reservoir Site

No hazardous waste or hazardous materials facilities and no known hazardous waste sites were identified within the 500-foot online search radius of the footprint of the reservoir site. The closest RCRA site to the reservoir is the GPC – Hulsey Lane facility located approximately 0.6 miles southwest of the proposed reservoir site. General field observations and desktop surveys conducted for the Glades Reservoir site area noted several structures located within the proposed reservoir footprint area.

Depending on the age of the structures (pre-1979) and the construction materials used, ACM, PCB-containing dielectric fluids, and lead-based paint may be present. Prior to any construction or demolition work on the structures, on-site surveys should be conducted to determine whether or not these materials are present. If the presence of ACM, lead-based paint, or PCBs is confirmed, the material would be disposed of in accordance with local, state, or federal regulations.

4.14.1.3 Reservoir Transmission System

4.14.1.4 To Lakeside WTP

Several RCRA reporting facilities were identified within the 500-foot online search radius of the transmission main that would extend from the reservoir site to the Lakeside WTP. These facilities and their locations in regards to the transmission system are described below in **Table 4.83.** These facilities should not be considered a hazard to the transmission system, as they have no recent violations (within two years) and are not in any state or federal remediation programs. No structures were noted within the footprint of the transmission main and WTP; therefore, ACM, lead-based paint, and PCBs are not likely present.

Table 4.83 RCRA Reporting Facilities within 500 Feet of Reservoir Transmission System

Facility Name	Location (Address, Latitude, Longitude)	Distance from Transmission Line
Avery Dennison	4350 Avery Drive, Flowery Branch, GA (34.20119, -83.89873)	450' west of transmission line, 0.51 mile north of line's intersection with Atlanta Highway
Tunco Manufacturing Co, Inc.	Thurmond Tanner Road, Flowery Branch, GA (34.214709, -83.88434)	316' west of transmission line, at the line's intersection with Plainview Road.
985 Collision Center	4643 Smithson Blvd., Oakwood, GA (34.22251, -83.87165)	100' northwest of transmission line, 0.35 miles southwest of the line's intersection with Mundy Mill Road.
Piedmont Laboratories	2030 Old Candler Road, Gainesville, GA (34.267844, -83.816838)	500' southeast of transmission line, 0.10 miles north of the line's intersection with Queen City Parkway.

4.14.1.5 To New Glades Reservoir WTP

No hazardous waste or hazardous materials facilities and no known hazardous waste sites were identified within the 500-foot online search radius of the footprint of the transmission main that would extend from the Glades Reservoir to the new Glades Reservoir WTP. The closest RCRA associated facility site is the GPC – Hulsey Lane facility located approximately 0.9 mile southwest of the Glades Reservoir WTP. No structures were noted within the footprint of the transmission lines and WTP; therefore, ACM, lead-based paint, and PCBs are not likely present.

4.14.1.6 Re-Routed Roads

No hazardous waste or hazardous materials facilities and no known hazardous waste sites were identified within the 500-foot online search radius of the new proposed roads that will provide access to the reservoir site. The closest RCRA site is the GPC – Hulsey Lane facility located approximately 0.3 mile south of the eastern roadway known as Parkway B Alignment. No structures were noted within the footprint of the proposed new roads; therefore, ACM, lead-based paint, and PCBs are not likely present.

4.14.2 White Creek Reservoir

4.14.2.1 River Water Transmission System

No hazardous waste or hazardous materials facilities and no known hazardous waste sites were identified within the 500-foot online search radius of the footprint of the raw water transmission main, intake, and pump station that will travel from the Chattahoochee River to the White Creek Reservoir. The closest RCRA site is the Fonda Milling Company located approximately 2.63 miles northeast of the transmission lines. No structures were noted within the footprint of the raw water transmission main, intake, and pump station; therefore, ACM, lead-based paint, and PCBs are not likely present.

4.14.2.2 Reservoir Site

No hazardous waste or hazardous materials facilities and no known hazardous waste sites were identified within the 500-foot online search radius of the footprint of the White Creek Reservoir site. The closest RCRA site to the reservoir is the Fonda Milling Company located approximately 0.7 mile northeast of the proposed reservoir site. General field observations and desktop surveys conducted for

the White Creek Reservoir site area noted several structures located within the proposed reservoir footprint area.

Depending on the age of the structures (pre-1979) and the construction materials used, ACM, PCB-containing dielectric fluids, and lead-based paint may be present. Prior to any construction or demolition work on the structures on-site surveys should be conducted to determine whether or not these materials are present. If the presence of ACM, lead-based paint, or PCBs is confirmed the material would be disposed of in accordance with local, state, or federal regulations.

4.14.2.3 Reservoir Water Transmission System

Several RCRA reporting facilities were identified within the 500-foot online search radius of the transmission main that would extend from the reservoir site to the Lakeside WTP. These facilities and their locations in regard to the transmission system are described above **Table 4.83**. These facilities should not be considered a hazard to the transmission system as they have no recent (within two years) violations and are not in any state or federal remediation programs. No structures were noted within the footprint of the transmission main and WTP; therefore, ACM, lead-based paint, and PCBs are not likely present.

4.14.2.4 Re-routed Roads

No hazardous waste or hazardous materials facilities and no known hazardous waste sites were identified within the 500-foot online search radius of the new proposed roadways that will provide access to the reservoir site. The closest RCRA site is the Fonda Milling Company located approximately 0.66 mile northeast of the northern-most cul-de-sac. Field surveys and desktop surveys conducted for the White Creek Reservoir site area noted several structures located within the footprint of the new proposed roadways. Depending on the age of the structures (pre-1979) and the construction materials used, ACM, PCB-containing dielectric fluids, and lead-based paint may be present. Prior to any construction or demolition work on the structures, on-site surveys should be conducted to determine whether or not these materials are present. If the presence of ACM, lead-based paint, or PCBs is confirmed the material would be disposed of in accordance with local, state, or federal regulations.

4.14.2.5 No Action Alternative

The No Action Alternative would have no hazardous waste impacts because there would be no installation of the reservoir, dam, pump stations, WTP, or river or reservoir pipelines.

4.14.2.6 Mitigation

On-site surveys should be conducted to determine whether or not ACM, lead-based paint, or PCBs materials are present prior to any construction or demolition work on the structures located within the footprint of the reservoirs and their associated piping and roadways. If the presence of ACM, lead-based paint, or PCBs is confirmed the materials would be disposed of in accordance with local, state, or federal regulations.

4.14.2.7 Unavoidable Adverse Impacts

No unavoidable hazardous materials impacts would occur under any alternative as a result of project implementation, unless on-site surveys of parcels to be acquired as a result of reservoir impacts indicates there is previous contamination due to ACM, lead-based paint or PCBs.

Table 4.84 below provides a summary of hazardous materials impacts for all alternatives.

Table 4.84 Summary of All Alternatives- Hazardous Materials

Alternative #	Alternative ID	Hazardous Materials Impacts [1]
Applicant	L18-G50-PT	None
1	L18-G42-PT	None
2	L18-G42-PL	None
3	L18-G42-WTP	None
4	L30-G30-PT	None
5	L30-G30-PL	None
6	L30-G30-WTP	None
7	L43-G17-PT	None
8	L43-G17-PL	None
9	L43-G17-WTP	None
10	L43-W17-PT	None
11	L43-W17-PL	None
No Action	L60	NA

Note:

[1] Pending on-site surveys of individual parcels to confirm absence of asbestos-containing materials, lead-based paint or polychlorinated biphenyls.

4.15 Cumulative Effects

4.15.1 Introduction

The Council on Environmental Quality (CEQ) regulations for compliance with the National Environmental Policy Act (NEPA) define cumulative impacts as "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions and regardless of what agency (federal or non-federal) or person undertakes such actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time" (40 CFR 1508.7). This regulation refers to the cumulative impact of direct and indirect impacts of the Proposed Project and its alternatives when added to the aggregate impacts of past, present, and reasonably foreseeable future actions.

An action (i.e. an existing or Proposed Project) must meet three criteria to warrant inclusion in the cumulative effect analysis. It must:

1. Affect a resource or resources potentially affected by the Proposed Project for which the cumulative impacts analysis is being undertaken;
2. Cause the impact within all, or part, of the project area; and
3. Cause this impact within all, or part, of the timespan for the potential impact from the Proposed Project.

4.15.2 Methodology

The cumulative impacts analysis for the Glades Reservoir DEIS evaluates past, present, and reasonably foreseeable future actions that, when combined with one of the Proposed Project alternatives, result in a cumulative effect on the environment. Consideration of the above-listed criteria was integral in shaping the scope of review for this cumulative impacts analysis, determining the geographic area in which the actions are considered, the types of actions included, the environmental resources investigated, and the timeframe for actions considered.

4.15.2.1 Spatial Extent of Analysis

Both land-based and water-based actions were considered for the cumulative impacts analysis. The cumulative impacts on surface water management were analyzed using the HEC ResSim model for the ACF Basin based on operating rules in the Draft 1989 WCM. HEC ResSim modeling of the action alternatives demonstrated that potentially significant hydrologic effects are confined to Lake Lanier and the upstream Chattahoochee watershed because of the size and location of Lake Lanier in relation to the magnitude of Glades Reservoir and its alternatives and also because the "balanced" manner that the ACF reservoir system is managed. Therefore, the spatial extent of potentially significant hydrologic effects of additional reasonably foreseeable actions upstream of Lake Lanier will be similarly confined to this upper Chattahoochee watershed.

Therefore, this DEIS evaluates cumulative impacts resulting from water-based actions that are likely to occur within the Chattahoochee River Watershed upstream of the alternatives, and downstream to Lake

Lanier. The boundary of the cumulative impacts analysis for water-based actions is bounded by the HUC8 watershed for the Upper Chattahoochee River (03130001) shown in **Figure 4.86**.

Figure 4.86 Cumulative Impacts Boundary – Water-based Actions

Water-based actions were identified as projects that submitted water supply requests, permit applications (such as 404 permits) to the Corps, or have recently obtained permits.

For Glades Reservoir alternatives, Hall County was selected as the geographic area of evaluation for the cumulative effects analysis of land-based actions. Hall County is the water service area for the Proposed Project, and the Purpose and Need of the Proposed Project is to meet and support the future needs of Hall County. Land-based actions were identified by reviewing various city and county permitting records and master plans, the GHCCP (GHCCP, 2005), and the Gainesville-Hall MPO 2040 Metropolitan Transportation Plan (August 2011). For White Creek Reservoir alternatives, no reasonably foreseeable land-based development projects were identified within the upper Chattahoochee River watershed within White County at the time the research was conducted for this cumulative impacts analysis.

4.15.2.2 Temporal Extent of Analysis

The temporal extent of the cumulative impacts analysis includes past, present, and reasonably foreseeable future actions. In accordance with CEQ Guidance on the Consideration of Past Actions in Cumulative Effects Analysis (2005), the guidance states that "generally, agencies can conduct an adequate cumulative effects analysis by focusing on the current aggregate effects of past actions without delving into the historical details of individual past actions." Based on this guidance, this DEIS will focus the cumulative effects analysis on present and future actions. The cumulative effects of past actions are already reflected in the historical hydrology and the characterization of baseline conditions.

4.15.2.3 Selection and Evaluation of Factors for Cumulative Impacts Analysis

The environmental effects assessment of the Proposed Project, presented earlier in this chapter, indicates the extent to which different environmental resources will be impacted by the construction and operation of the Glades Reservoir. Where no measurable impacts to a resource are anticipated to result from the Proposed Project, that resource is not in this cumulative impacts analysis in accordance with CEQ guidance summarized above. Per the CEQ guidelines, the cumulative impacts analysis focuses on resources where some impact is associated with the Proposed Project, and there is a potential for of cumulative or synergistic impacts based on scope, location, and timing of other actions. Quantitative analyses were performed on the resources of concern based on best available information of the present and future actions to determine if they contribute to significant cumulative effects. The bases for the cumulative impacts analysis (whether it is a land-based or water-based activity) and how the analysis was performed (qualitative or quantitative) are summarized in **Table 4.85**.

Table 4.85 Type of Cumulative Effects Analysis by Resource Area

Resource Area	Impact Type		Notes	Analysis Type	
	Water-Based	Land-Based		Qualitative	Quantitative
Water Use and Management					
ACF Basin Water Management	X		Georgia's water supply request of 705 mgd withdrawal (including 297 mgd from Lake Lanier) from the upper Chattahoochee River Basin and the Corps Mobile's ongoing evaluation to update the ACF Basin WCM would be the focus of cumulative effects analysis. Hydrological impacts downstream of the Proposed Project were modeled with the ResSim program.		X
Water Quality					
Downstream water quality	X		Based on the hydrological modeling results, the majority of the impacts caused by the Proposed Project occurs above Buford Dam. Because there are limited impact below Buford Dam and Lake Lanier, cumulative effects analysis for water quality is limited to the area above Buford Dam.	X	
Soils and Geology					
Soil erosion, topsoil loss, and permanent construction impacts and prime and unique farmlands		X	Data for individual projects sites are not available for detailed analysis; total soil disturbance anticipated in the watershed is discussed.	X	
Mining and mineral needs		X	Not included – no mining or mineral resources affected by the Proposed Project or alternatives.	N/A	N/A
Land Use		X	Changes to land use discussed with analysis of projected 2050 land use. This includes land use changes associated with other land based actions.		X
Climate- GHG		X	The loss of forest land, which is related to GHG is discussed with analysis of 2050 land use.	X	
Biological Resources					
Upland Vegetation		X	Impacts assessed based on land use changes and loss of upland vegetation.		X
Wetlands, Streams, and Other Waters	X		Impacts determined based on the Corps permit databases.		X
Wildlife		X	Impacts assessed based on land use changes and data from GHCCP.		
Socioeconomic Conditions					
Housing, Communities, and Transportation		X	Impacts assessed based on land use changes and data from GHCCP and Transportation Plan.	X	
Demographics and Environmental Justice		X	Impacts assessed based on land use changes and data from GHCCP.	X	
Recreation	X	X	Impacts to water-based recreation in the Chattahoochee River and Corps reservoirs are evaluated based on streamflow analysis and ResSim modeling. Impacts to land-based recreation (such as parks and green space etc.) are based on land use changes and data from GHCCP and Transportation Plan.	X	
Economics		X	Impacts assessed based on land use changes and data from GHCCP and Transportation Plan.	X	

Resource Area	Impact Type: Water-Based	Impact Type: Land-Based	Notes	Analysis Type: Qualitative	Analysis Type: Quantitative
Visual and Aesthetic Resources		X	Impacts assessed based on land use changes and data from GHCCP.	X	
Air Quality		X	Impacts assessed based on land use changes and data from GHCCP and Transportation Plan.	X	
Noise		X	Impacts assessed based on land use changes and data from GHCCP and Transportation Plan.	X	
Cultural Resources		X	Impacts assessed based on land use changes and data from GHCCP and Transportation Plan.	X	
Hazardous Materials		X	Not included – no impacts to hazardous materials from Proposed Project or alternatives.	N/A	N/A

4.15.2.4 Identification of Present and Reasonably Foreseeable Projects

Projects listed in **Table 4.86** detail the major water-based actions included in the cumulative impacts analysis. **Table 4.87** and **Table 4.88** detail land-based actions from both development and transportation projects. A total of 48 land-based actions have been identified based on best available information. Data were obtained from reviews of master plans, comprehensive plans, and permit submitted for projects within Hall County, including the Cities of Braselton, Oakwood, and Buford. Similar information was requested from the City of Flowery Branch, however no data was provided for this DEIS.

Table 4.86 Cumulative Impacts – Water-based Actions

Action	Potential Resources Cumulatively Affected
Georgia Water Supply Request (2013)[1]	Water Resources
ACF Basin WCM Update DEIS [2]	Water Resources
Corps Identified Wetland Impacts[3]	Biological Resources
Corps Identified Stream Impacts[3]	Biological Resources

[1] Submitted in January 2013 by the state of Georgia to the Corps Mobile District.
[2] Conducted by the Corps Mobile District; scheduled to be published in September/October 2015.
[3] Based on permit database from the Corps Savannah District.

Table 4.87 Cumulative Impacts – Land-based Actions, Development Projects

	Size (Acres)	Project Name	Non-Residential			Residential		Anticipated Build Out
			Commercial (SF)	Office/ Institutional (SF)	Industrial (SF)	Single Family Units	Multi-Family Units	
1	5.5	(Abernathy Tract) Club Highpoint Condos	---	---	---	---	34	2025
2	102	Ahaluna Subdivision	---	---	---	199	---	2025
3	4.6	Allied Foam Addition	---	---	30,000	---	---	2016
4	117	Amberliegh Subdivision	---	---	---	275	---	2017
5	3.4	Ashton Hall Assisted Living	---	54,000	---	---	---	2016
6	1.6	Atlanta Gastroenterology	---	10,780	---	---	---	2016
7	18.2	AYC Plastics Addition	---	---	21,270	---	---	2015
8	2.0	Beehive Homes Assisted Living	---	38,000	---	---	---	2017
9	---	Bells Mill Landing	---	---	---	50	---	2017
10	2.5	Brenau Residence Hall	---	23,000	---	---	---	2016
11	23	Central Park Mixed Use	40,000	350,000	---	---	---	2020
12	1,135	Cane Creek	1,022,400	1,776,000	0	2,054	923	2030
13	2	Chastain Janitorial Supply	---	---	27,500	---	---	2015
14	470	Cresswind Subdivision	---	---	---	950	---	2018
15	168.5	Gainesville Business Park	---	1,292,000	---	---	---	2025
16	500	Gateway Industrial Park	200,000	---	2,500,000	---	---	2025
17	476	Gateway Village	500,000	---	---	186	310	2030
18	5,472	Hagen Creek	500,000	500,000	---	5,832	1,888	2030
19	5.5	Hall County Sherriff's Complex	---	49,500	---	---	---	2015
20	219	Heritage Point Subdivision	---	---	---	292	97	2018
21	10.4	Lakeshore Villas (Mercer Tract)	---	---	---	---	---	---
22	N/A	Lost River Condos	10,000	---	---	550	---	2023
23	604	Mundy Mill Mixed-Use	885,000	806,000	---	1,148	1,235	2020
24	152	Northgate Industrial	80,000	405,000	---	---	---	2020

It is anticipated that these land-based actions will have cumulative impacts on the below resources:

- Water Resources
- Water Quality
- Soils and Geology
- Land Use
- Biological Resources
- Socioeconomic Conditions
- Visual and Aesthetic Resources
- Air Quality
- Cultural Resources

	Size (Acres)	Project Name	Non-Residential			Residential		Anticipated Build Out
			Commercial (SF)	Office/ Institutional (SF)	Industrial (SF)	Single Family Units	Multi-Family Units	
25	34	Northlake Square	200,000	---	---	---	---	2016
26	68	New Holland Market	400,000	200,000	---	---	300	2018
27	217	Portofino	---	---	---	261	---	2022
28	83	Riverbrooke Village	316,000	---	---	---	220	2022
29	6	Summit Place Apts. PH 2	---	---	---	---	96	2016
30	965	Sussex	24,000	---	---	977	1,293	2025
31	3.4	Swann Drive Villas Apts.	---	---	---	---	24	2015
32	22	Trees of Gainesville Apts.	---	---	---	---	348	2016
33	26	Wilson Drive Subdivision	---	---	---	55	---	2018
34	92	Windsor Forest Subdivision	---	---	---	90	---	2020
35	43	Performance Food Group			521,000			2017
36	125	Chateau Elan				210		2020
37	350	Sterling on the Lake				900		2022
38	120	Village at Deaton Creek				325		2020
39	9	Friendship Road, LLC	10,000					2018
40	13	Hawthorne Village				105		2017
41	59	Majestic RACO			298,000			2018
42	4	Sherwin Williams			100,000			2017
43	6	Crawford Oaks				60		2017
44	10	Pattillo – Spec			280,000			2019
45	3	Jinsung			50,000			2017
46	20	High Point Medical Arts		42,000				2016
47	8.5	Riverstone Medical Center		90,000				2016
48	5	Friendship Springs Village Performing Arts Center	40,000					2017
Total	11,786	TOTAL	4,227,400	5,636,280	3,827,770	14,519	6,768	

It is anticipated that these land-based actions will have cumulative impacts on the below resources:

- Water Resources
- Water Quality
- Soils and Geology
- Land Use
- Biological Resources
- Socioeconomic Conditions
- Visual and Aesthetic Resources
- Air Quality
- Cultural Resources

Table 4.88 Cumulative Impacts – Land-based Actions, Transportation Projects[1]

Project Name	Type	Schedule			Potential Resources Cumulatively Affected
		Tier 1 (2012-2017)	Tier 2 (2018-2030)	Tier 3 (2031-2040)	
Central Hall Recreation and Multi-Use Trail	Bicycle and Pedestrian Projects	X			WR,BR, CR, V
Howard Road Extension from SR 365 to Old Cornelia Highway	New Location Roadway Projects		X		WR,BR, AQ, N, CR, V
I-985 – New Interchange North of SR 13 Near Martin Road	New Interchange		X		WR,BR, AQ, N, CR, V
Martin Road – Falcon Pkwy to SR 53/Winder Hwy	Roadway Widening		X		WR,BR, AQ, N, CR, V
McEver Rd from SR 347/Friendship Rd to Jim Crow Rd	Roadway Widening		X		WR, BR, AQ, N, CR, V
McEver Road from Jim Crow Rd to SR 53	Roadway Widening			X	WR,BR, AQ, N, S, CR, V
Northern Connector - Connection Between SR 60/Thompson Bridge Road and SR 365	New Location Roadway Projects			X	WR, BR, AQ, N, S, CR, V
Old Cornelia Hwy – Exist. 4-lane E of I-985 to Joe Chandler Road	Roadway Widening			X	WR,BR, AQ, N, CR, V
Relocation of Lights Ferry Rd from Gainesville St to SR 13	New Location Roadway Projects		X		WR,BR, AQ, N, CR, V
Sardis Road Connector – SR 60/Thompson Bridge to Sardis/Chestatee Road	Roadway Widening		X		WR,BR, AQ, N, CR, V
South Enota Drive - Widen from 2 To 4 Lanes from Park Hill to Downey Blvd	Roadway Widening			X	WR,BR, AQ, N, CR, V
Spout Springs Rd - Hog Mountain Rd to Gwinnett Co. Line	Roadway Widening		X		WR,BR, AQ, N, CR, S, V
SR 13/Atlanta Highway - Radford Road to SR 53/Winder Hwy	Roadway Widening		X		WR,BR, AQ, N, CR, S, V
SR 13/Atlanta Highway Widening & Memorial Park Drive Widening – Frontage Road to Browns Bridge	Roadway Widening			X	WR,BR, AQ, N, CR, S, V
SR 13/Atlanta Highway Widening from SR 347 to Radford Rd	Roadway Widening			X	WR,BR, AQ, N, CR, V
SR 13/Atlanta Hwy - From Gwinnett County line to SR 347/Lanier Islands Parkway	Roadway Widening	X			WR,BR, AQ, N, CR, V
SR 136/Price Road @ Chestatee River	Bridge Projects		X		WR, BR, AQ, N, CR, V
SR 211/Old Winder Highway – SR 53/Winder Hwy to SR 347 on new alignment	Roadway Widening	X	X		WR,BR, AQ, N, CR, V
SR 284/Clarks Bridge Road at Chattahoochee River	Bridge Projects	X			WR, BR, AQ, N, CR, V
SR 323/Gillsville Hwy - US 129/Athens Hwy to E of SR 82/Holly Springs Road	Roadway Widening			X	WR,BR, AQ, N, S, CR, V
SR 332/Poplar Springs Road at Walnut Creek	Bridge Projects		X		WR,BR, AQ, N, CR, V
SR 347/Friendship Road – I-985 to McEver Road Phase I	Roadway Widening	X			WR,BR, AQ, N, CR, V
SR 347/Friendship Road From I-985 to SR 211	Roadway Widening	X			WR,BR, AQ, N, CR, V
SR 347/Lanier Islands Pkwy - Mc Ever Rd to Lake Lanier Islands	Roadway Widening	X			WR, BR, AQ, N, CR, S, V
SR 369/Brown's Br Road – Forsyth Co. Line to SR 53/McEver Road	Roadway Widening		X		WR, BR, AQ, N, CR, V

Project Name	Type	Schedule: Tier 1 (2012-2017)	Schedule: Tier 2 (2018-2030)	Schedule: Tier 3 (2031-2040)	Potential Resources Cumulatively Affected
SR 369/Browns Bridge Rd at Chattahoochee River	Bridge Projects	X			WR, BR, AQ, N, CR, V
SR 52 at Candler Creek	Bridge Projects	X			WR,BR, AQ, N, CR, V
SR 52/Lula Road – 1 mile north of SR 365 to south of Julian Wiley Road	Roadway Widening		X		WR, BR, AQ, N, CR, S, V
SR 52/Lula Road at Chattahoochee River	Bridge Projects				WR, BR, AQ, N, CR, V
SR 53/Dawsonville Hwy at Chestatee River	Bridge Projects	X			WR, BR, AQ, N, CR, V
SR 53/Dawsonville Hwy westbound at Chattahoochee River	Bridge Projects		X		WR, BR, AQ, N, CR, V
SR 53/Winder Hwy from I-85 in Jackson Co. to SR 211/Tanners Mill Road	Roadway Widening		X		WR,BR, AQ, N, CR, V
SR 60/Thompson Bridge Road - SR 136/Price Road to Hall County Line	Roadway Widening	X			WR, BR, AQ, N, CR, V
US 129 - SR 284/Clarks Bridge Road to White Co. Line	Roadway Widening		X		WR,BR, AQ, N, CR, V
US 129/Athens Hwy from SR 323/Gillsville Hwy to SR 332/Talmo in Jackson County	Roadway Widening	X			WR,BR, AQ, N, CR, V
US 129/Cleveland Hwy – Limestone Pkwy to Nopone Road	Roadway Widening		X		WR, BR, AQ, N, CR, S, V
US 129/Cleveland Hwy - N of Nopone/J Hood Road to SR 284/Clarks Bridge Road	Roadway Widening		X		WR,BR, AQ, N, CR, V
US 129/Cleveland Hwy at Chattahoochee River	Bridge Projects		X		WR, BR, AQ, N, CR, V
US 129/Cleveland Hwy at East Fork Little River (Bells Mill)	Bridge Projects		X		WR, BR, AQ, N, CR, V
Widening of Joe Chandler Road from SR 52 to Old Cornelia Hwy	Roadway Widening			X	WR,BR, AQ, N, CR, V

[1] Projects and impacts identified from Gainesville-Hall MPO 2040 Metropolitan Transportation Plan (August 2011)

WR – Water Resources
BR – Biological Resources
S – Socioeconomic Conditions
V – Visual and Aesthetic Resources
AQ – Air Quality
N – Noise
CR – Cultural Resources

4.15.3 Analysis of Cumulative Impacts

The cumulative impacts analysis is organized by resource area. The anticipated impacts are described below.

4.15.3.1 Water Resources Management and Assessment

The analysis in this DEIS was structured to isolate and understand the impacts on surface water resource management caused by the overall increase of demand of the Metro Atlanta area and the entire ACF Basin from the effects of the Proposed Project or its alternatives. The hydrological modeling is based on the following key attributes: 1) Georgia's water supply request of 705 mgd withdrawal from the upper Chattahoochee River Basin (including 297 mgd from Lake Lanier), 2) water supply from Glades Reservoir or an alternative is part of, not in addition to, the 297 mgd total withdrawal from Lake Lanier. This DEIS analyzes the impacts to the Chattahoochee River, Lake Lanier and other potential downstream impacts based on the operating rules in the draft 1989 ACF Basin WCM., The DEIS being prepared by the Corps, Mobile District evaluates potential changes to the WCM and the effects of potential changes in water management and reservoir operating procedures governed by the WCM Update.

Impacts of System Demand Increase from 2011 to 2060

This DEIS compares the 2060 conditions without the construction of the Glades Reservoir (No Action Alternative) to the 2011 Baseline in order to define the anticipated hydrologic changes that would occur as basin demand grows and other projects/actions come on-line.

These hydrologic changes are anticipated to occur regardless of the proposed Glades Reservoir and are not an impact caused by the Proposed Project. This was demonstrated by comparing the action alternatives (with Glades or White Creek Reservoir) to the No Action Alternative (see figures and tables presented in Section 4.3 Surface Water Management and Assessment, in particular, Section 4.3.5 Downstream Impacts).

The projected 2060 demand for the Metro Atlanta area is based on projections provided by Georgia EPD (2013 water supply request). These projections are considered to be the maximum Chattahoochee River water withdrawals for the Metro Atlanta area for the 2060 conditions for the purposes of this DEIS. These net withdrawals are distributed among five nodes in the ResSim model: Buford, Norcross, Morgan Falls, Atlanta, and Whitesburg.

Table 4.89 summarizes the average annual water supply demands and treated wastewater returns for the Metro Atlanta area for both the Baseline (2011) and 2060 conditions. For the Metro Atlanta area, the total withdrawal for the Baseline 2011 condition is 397 mgd annual average day (AAD). The average return rate of treated wastewater for the entire Metro Atlanta area was approximately 65% based on actual withdrawal and return records for the year 2011 (provided by the Corps). The total net consumptive use for the Metro Atlanta area for the Baseline Condition is 139 mgd AAD based on Georgia's 2013 water supply request to the Corps. The 2060 total withdrawal from the Metro Atlanta area is anticipated to increase to 705 mgd AAD. Georgia anticipates the return rate increase to 78%, therefore the net consumptive use for the Metro Atlanta area is 154 mgd AAD for the 2060 conditions.

Table 4.89 Summary of Annual Average Water Supply Withdrawals and Treated Wastewater Returns for Metro Atlanta Area[1] for the Baseline (2011) and 2060 Demand Conditions.

	Baseline (2011)	2060
Water Supply Withdrawals (mgd)	397	705
Treated Effluent Returns (mgd)	258	551
Net Consumptive Use (mgd)	139	154
Return Rate (%)	65%	78%

[1] Metro Atlanta area is represented by the withdrawals and returns in following nodes in the ResSim model: Buford, Norcross, Morgan Falls, Atlanta, and Whitesburg.

The modeling indicates that the increase in overall projected system demand from 2011 to 2060 would result in some adverse impacts; however, most of the adverse impacts would occur in the upper Chattahoochee Basin (in particular the operation of Lake Lanier) due to the increase in net consumptive use in the Metro Atlanta area (**Table 4.89**) and how the existing WCM rules operate to prioritize the maintenance of certain flow levels downstream of Buford Dam. The increase in overall system demand from 2011 to 2060 is predicted to have the following effects (comparing the No Action Alternative (L60) to the Baseline (2011)):

Impacts to Streamflow

- An estimated 4.1% decrease in average daily streamflow into Lake Lanier over the 73-year simulation period.
- An estimated 0.7% decrease in average daily streamflow at the Georgia/Florida State Line.
    - The number of days the streamflow at the state line is equal or less than 5000 cfs (drought conditions) is predicted to increase from 1 day in Baseline to 65 days in 2060 conditions
    - The number of days the streamflow at the state line is equal to 4550 cfs (extreme drought conditions and minimum possible release) is predicted to increase from 0 days in Baseline to 61 days in 2060 conditions

Impacts to Reservoir Pool Elevations

- On average, an estimated 1-foot decrease for daily pool level at Lake Lanier; and a 0.05-foot decrease in daily pool level at West Point Lake. No effects on pool levels for the reservoirs downstream of West Point (W.F. George and Woodruff) based on the system's existing operation rules.
- A decrease of approximately 5.5 feet in the Lake Lanier minimum daily pool level during a critical drought period similar to the 2007-2009 drought.

Impacts to Reservoir Discharges

- An estimated 0.7% decrease in average daily discharge below Buford Dam. The impact reduces downstream to a 0.1% decrease in average daily discharge below Walter F. George and Jim Woodruff dams.

Impacts to Hydropower Generation

- An overall reduction of 1.5% in the combined average annual hydropower production for the four federal reservoirs. Most of this can be attributed to a 6.3% reduction in average daily energy production at Buford Dam.
- An estimated 0.9 foot reduction in average daily head at Buford Dam. No impacts on average daily head downstream of Buford Dam.
- An estimated 0.7% reduction in average daily plant capacity at Buford Dam (due to reduced head on the turbines from reduced reservoir levels). No impacts on average daily plant capacity downstream of Buford Dam.

Recreation

- The increase in system demand from 2011 to 2060 would have an adverse impact on recreation at Lake Lanier, but would have minimal to no impacts on recreation in reservoirs below Buford Dam based on the current 1989 draft WCM operating rules. Lake Lanier will fall below the Recreational Impact Levels (1063 ft MSL) 17 more times under Future Demand Conditions (2060) than under Baseline (2011) conditions. Very minimal to no effects on recreational impact for the reservoirs downstream of Lanier (only 1 additional year below RIL for West Point, and W.F. George; no effect on Jim Woodruff) based on the system's existing operation rules.
- The addition of Glades Reservoir would increase the overall ACF system storage volume and would result in a slight beneficial recreational impact at Lake Lanier (increased minimum daily lake level elevation during drought periods and decreased time below Lake Lanier's designed Recreational Impact Levels).

Drought Operations

- An increase in the number of times drought operations are triggered at Jim Woodruff (from 3 in 2011 to 5 in 2060). The increase in total system water demand would increase the percentage of time that the ACF system is under "drought operation" (10.8% of the time under 2060 conditions) when compared to the baseline (6.1% at 2011 conditions).

4.15.3.2 Water Quality

Potential cumulative effects from present and future foreseeable actions could range from short-term effects during construction of infrastructure to long-term effects associated with increased water consumption and changes in water management including changed streamflows and reservoir levels. Short term effects are presented first; followed by long-term effects

The potential cumulative impacts of the reasonably foreseeable projects listed in **Table 4.87** and **Table 4.88** could result from stormwater runoff during construction of new housing, commercial and industrial facilities and water and wastewater storage, treatment, conveyance and distribution systems. The level of impacts would depend on allowed construction methods affecting the control and management of precipitation events, sediment, treatments, and releases. The impacts could be avoided or minimized through compliance with current and potential future regulatory requirements and the use of best

management practices such as sediment and erosion control and stormwater pollution and prevention plans.

As shown in the hydrological analysis for the evaluation of downstream impacts in the ACF Basin, the greatest long-term cumulative water quality impact would result from the reduction of Lake Lanier water levels caused by the overall water demand increase in Metro Atlanta area. On average, the lake level would see a one-foot reduction from the Baseline Conditions; during severe drought similar to the 2008 drought conditions, the lake level may decrease as much as 5 feet from the Baseline Conditions. There is the potential for associated long-term and short-term cumulative water quality impacts resulting from less water being stored in Lake Lanier. To avoid or minimize the potential impact as the quantity of treated effluent return increases in the future, it is anticipated that the Georgia EPD would continue to require stringent limits (especially low phosphorus limit) in the effluent discharge to Lake Lanier in order to meet the water quality standards (including total maximum daily loads). Advanced treatment would continue to be required for entities discharging into Lake Lanier to meet the effluent discharge limits.

Cumulative water quality impacts downstream of Lake Lanier are expected to be minimal because the there is no discernible change in water levels and streamflow below Buford Dam. The Corps, Mobile District is currently conducting a DEIS to evaluate the impacts (including water quality impacts) of its planned ACF Basin WCM Update. In this WCM DEIS, operational changes are being evaluated to minimize the impacts of future demand increase in the ACF system and to balance the multiple purposes authorized for the Corps projects in the ACF Basin.

4.15.3.3 Soils and Geology

Impacts to soils and geology may stem from land disturbance associated with future land-based actions. The Proposed Project and alternatives are anticipated to disturb directly between zero (No Action) and 1,115 acres (Alternatives 2, 5, 8), with additional land-based actions disturbing cumulatively up to 11,790 (No Action) and 12,900 acres (Alternatives 2, 5, 8) by 2060.

Agriculture has historically been a major part of the Hall County economy and land use since it became a county in the 1800s. Historical agricultural uses are in the form of livestock, poultry houses, and dairy farms. Agricultural acreage is rapidly diminishing within the southern portions of the county, replaced as residential and commercial developments began in the late 1990s. In 1994, a reported 60,700 acres of land within Hall County were used in agricultural practices, but as the demand for suburban housing increases the agricultural lands have decreased to approximately 24,000 acres (2008 GLUT). Suburban-style housing has resulted in a decrease in agricultural and cultivated land.

Given these documented trends, cumulative impacts to farmland are anticipated to continue with the proposed land development projects in Hall County, regardless of the Proposed Project. Individually, the Glades Reservoir construction would impact 221 acres of farmland within Hall County, including 12 acres of prime farmland. Therefore, the Proposed Project would contribute to a cumulative farmland impact within the county.

Hall County as whole is comprised of 2.6% Prime Farmland (11.2 sq mi) and 10.1% Farmland of State Importance (43.0 sq mi) by area based on the 2010 U.S. Department of Agriculture (USDA) Soil Survey for Barrow, Hall, and Jackson Counties, Georgia. It is assumed that a similar breakdown of farmland will be found in the areas to be disturbed for the reasonably foreseeable developments, thus the potential cumulative farmland impacts are shown in **Table 4.90**.

Table 4.90 Soils and Farmland Cumulative Impact Summary

Alternative #	Cumulative Impacts	Cumulative Disturbed Area (Acres)[1]	Assumed Cumulative Prime Farmland Disturbed (Acres)[1]	Assumed Cumulative Farmland of Statewide Importance Disturbed (Acres)[2]
Applicant	L18-G50-PT	12,805	333	1,293
1	L18-G42-PT	12,805	333	1,293
2	L18-G42-PL	12,900	335	1,303
3	L18-G42-WTP	12,850	334	1,298
4	L30-G30-PT	12,810	333	1,293
5	L30-G30-PL	12,900	335	1,303
6	L30-G30-WTP	12,840	334	1,297
7	L43-G17-PT	12,810	333	1,293
8	L43-G17-PL	12,900	335	1,303
9	L43-G17-WTP	12,830	334	1,296
10	L43-W17-PT	12,455	324	1,258
11	L43-W17-PL	12,575	327	1,270
No Action	L60	11,790	306	1,190

[1] Assumed 2.6% of all disturbed acres is Prime Farmland based on average Hall County soil composition.
[2] Assumed 10.1% of all disturbed acres is Farmland of State Importance based on average Hall County soil composition.

4.15.3.4 Land Use

Future Land Use (2050) data from GLUT was used to account for the cumulative impacts of land use changes within Hall County as a results of the projects listed in **Table 4.91** and **Table 4.92**.

The primary impacts to land use from the Proposed Project or its alternatives are the conversion of forest and/or agricultural lands to open water. The loss of forest and agricultural lands is also the largest cumulative impact as increased future development occurs across the county. **Table 4.91** compares the percentage land use by category between Baseline Conditions, future land use with the reasonably foreseeable proposed land-based actions, and cumulatively with action alternatives. **Table 4.92** summarizes the percent change in land use from the Baseline to future land use with the reasonably foreseeable land-based actions and cumulatively with the action alternatives.

Table 4.91 Land Use Cumulative Impact Summary – Hall County

NAME	Baseline Conditions	Future Land Use w/ Land-Based Actions	Future Land Use: Cumulative Impacts (with Action Alternatives)										
			Alt 1	Alt 2	Alt 3	Alt 4	Alt 5	Alt 6	Alt 7	Alt 8	Alt 9	Alt 10	Alt 11
Beaches/Dunes/Mud	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%
Open Water	9.3%	7.4%	7.8%	7.8%	7.8%	7.8%	7.8%	7.8%	7.8%	7.8%	7.8%	7.4%	7.4%
Utility Swaths	0.0%	0.3%	0.3%	0.3%	0.4%	0.3%	0.3%	0.4%	0.3%	0.3%	0.4%	0.3%	0.4%
Developed, Open Space	0.0%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%
Developed, Low Intensity[1]	15.3%	9.4%	9.4%	9.4%	9.4%	9.4%	9.4%	9.4%	9.4%	9.4%	9.4%	9.4%	9.4%
Developed, Medium Intensity	0.0%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%
Developed, High Intensity[1]	3.5%	1.4%	1.4%	1.4%	1.4%	1.4%	1.4%	1.4%	1.4%	1.4%	1.4%	1.4%	1.4%
Developed, Projected	0.0%	28.3%	28.3%	28.3%	28.3%	28.3%	28.3%	28.3%	28.3%	28.3%	28.3%	28.3%	28.3%
Clearcut/Sparse	4.3%	2.6%	2.6%	2.6%	2.6%	2.6%	2.6%	2.6%	2.6%	2.6%	2.6%	2.6%	2.6%
Quarries/Strip Mines	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Rock Outcrop	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Deciduous Forest	38.1%	24.3%	24.1%	24.1%	24.1%	24.1%	24.1%	24.1%	24.1%	24.1%	24.1%	24.3%	24.3%
Evergreen Forest	5.6%	3.8%	3.7%	3.7%	3.7%	3.7%	3.7%	3.7%	3.7%	3.7%	3.7%	3.8%	3.8%
Mixed Forest	3.5%	2.5%	2.4%	2.4%	2.4%	2.4%	2.4%	2.4%	2.4%	2.4%	2.4%	2.5%	2.5%
Golf Courses	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Pasture	19.2%	8.9%	8.8%	8.8%	8.8%	8.8%	8.8%	8.8%	8.8%	8.8%	8.8%	8.9%	8.9%
Forested Wetland	0.7%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%
Non-forested Wetland	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

[1] 2008 Land Use only had "Low Intensity Urban" and "High Intensity Urban" Land Use Categories – these were mapped with Developed, Low Intensity and Developed, High Intensity Respectively.

Table 4.92 Land Use Change from Baseline Conditions - Cumulative Impact Summary – Hall County

NAME	Land Use Change w/ Land-Based Actions	Land Use Change - Cumulative Impacts										
		Alt 1	Alt 2	Alt 3	Alt 4	Alt 5	Alt 6	Alt 7	Alt 8	Alt 9	Alt 10	Alt 11
Beaches/Dunes/Mud	-0.1%	-0.1%	-0.1%	-0.1%	-0.1%	-0.1%	-0.1%	-0.1%	-0.1%	-0.1%	-0.1%	-0.1%
Open Water	-1.8%	-1.5%	-1.5%	-1.5%	-1.5%	-1.5%	-1.5%	-1.5%	-1.5%	-1.5%	-1.8%	-1.8%
Utility Swaths	0.3%	0.3%	0.3%	0.4%	0.3%	0.3%	0.4%	0.3%	0.3%	0.4%	0.3%	0.4%
Developed, Open Space	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%
Developed, Low Intensity[1]	-5.8%	-5.8%	-5.8%	-5.9%	-5.8%	-5.8%	-5.9%	-5.8%	-5.8%	-5.9%	-5.8%	-5.9%
Developed, Medium Intensity	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%
Developed, High Intensity[1]	-2.1%	-2.1%	-2.1%	-2.1%	-2.1%	-2.1%	-2.1%	-2.1%	-2.1%	-2.1%	-2.1%	-2.1%
Developed, Projected	28.3%	28.3%	28.3%	28.3%	28.3%	28.3%	28.3%	28.3%	28.3%	28.3%	28.3%	28.3%
Clearcut/Sparse	-1.8%	-1.8%	-1.8%	-1.8%	-1.8%	-1.8%	-1.8%	-1.8%	-1.8%	-1.8%	-1.8%	-1.8%
Quarries/Strip Mines	-0.1%	-0.1%	-0.1%	-0.1%	-0.1%	-0.1%	-0.1%	-0.1%	-0.1%	-0.1%	-0.1%	-0.1%
Rock Outcrop	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Deciduous Forest	-13.8%	-14.0%	-14.0%	-14.0%	-14.0%	-14.0%	-14.0%	-14.0%	-14.0%	-14.0%	-13.8%	-13.8%
Evergreen Forest	-1.8%	-1.9%	-1.9%	-1.9%	-1.9%	-1.9%	-1.9%	-1.9%	-1.9%	-1.9%	-1.8%	-1.8%
Mixed Forest	-1.0%	-1.0%	-1.0%	-1.0%	-1.0%	-1.0%	-1.0%	-1.0%	-1.0%	-1.0%	-1.0%	-1.0%
Golf Courses	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Pasture	-10.3%	-10.3%	-10.3%	-10.3%	-10.4%	-10.3%	-10.3%	-10.3%	-10.3%	-10.3%	-10.3%	-10.3%
Forested Wetland	-0.1%	-0.1%	-0.1%	-0.1%	-0.1%	-0.1%	-0.1%	-0.1%	-0.1%	-0.1%	-0.1%	-0.1%
Non-forested Wetland	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

[1] 2008 Land Use only had “Low Intensity Urban” and “High Intensity Urban” Land Use Categories – these were mapped with Developed, Low Intensity and Developed, High Intensity Respectively.

4.15.3.5 Climate (Greenhouse Gas)

Greenhouse Gas

In this DEIS, the impacts on greenhouse gases (GHG) are estimated based on the loss of forest land and the energy required for pumping water from the Chattahoochee River and/or to the WTP in the action alternatives. The Glades Reservoir and White Creek Reservoir alternatives would contribute to carbon dioxide (CO_2) emissions, and project implementation would impact forested lands, causing a potential reduction of CO_2 sequestration and less GHG being removed from the environment. The impacts to forested lands that would occur from components of the alternatives are minor. Additional loss of forest is projected within the cumulative impacts which will result in lower capacity to remove or sequester GHG in the future. Based on **Table 4.91**, the deciduous forest as a percent of total county land use would decrease from 38% from Baseline to 24% under future conditions with the proposed land-based actions; the Proposed Project and its alternative would contribute to an additional 0.2% loss of deciduous forest in the future. Similarly with evergreen or mixed forest lands, the impacts of the reasonably foreseeable future land-based actions is predicted to be far greater than the impacts caused by the Proposed Project or its alternative.

The long-term cumulative GHG impacts from the Proposed Project would primarily result from the CO emissions by producing the energy required for pumping. These emissions will also contribute to GHGs; however, these levels would contribute to a small incremental increase of GHG as compared to activities anticipated from general population increases.

4.15.3.6 Biological Resources

Upland Vegetation

The most abundant habitat types that occur within Hall County are deciduous forest, evergreen forests, mixed forest, and pasture. In addition to the construction of the Proposed Project, cumulative adverse effects are expected to occur to upland vegetation as a result of the reasonably foreseeable future projects listed in **Table 4.91** and **Table 4.92.**

Estimated impacts to all vegetative communities are based on the GLUT database (comparison of 2008 to projected 2050 coverage). **Table 4.92** shows that there would be a 27% reduction in upland vegetation (approximately 72,000 acres) from the Baseline Conditions. This includes approximately a 14% reduction in deciduous forests, a 2% reduction in evergreen forests, a 1% reduction in mixed forests, and a 10% reduction in pastures.

Wetlands, Streams, and Other Waters

The proposed reservoir is located within the Upper Chattahoochee River watershed (HUC 03130001). The cumulative impacts analysis for wetlands and streams was conducted using NWI data along with information from the Corps Savannah District permit database within the HUC in this watershed. Historically, the Upper Chattahoochee River watershed contained approximately 14,700 acres of wetlands and 5.25 million linear feet of stream. Impacts previously permitted by the Corps through the Section 404 permit process consist of 415 acres (2.8 percent) of wetlands and 34.3 miles (181,395 linear

feet) approximately 3 percent of streams found within the NWI for this watershed. Cumulative impacts for the wetlands and streams within the Upper Chattahoochee Watershed are presented in **Table 4.93**. The data presented in the DEIS are based on standard Water of the U.S. evaluation criteria used prior to the 2015 final rulemaking (see **Section 4.8.2**).

Table 4.93 Wetland and Stream Cumulative Impact Summary

		Stream Impacts		Wetland Impacts	
Alternative #	Alternative ID	Linear Feet	% of Watershed	Acres	% of Watershed
Applicant	L18-G50-PT	275,545	5.2%	660	4.5%
1	L18-G42-PT	275,545	5.2%	660	4.5%
2	L18-G42-PL	275,770	5.3%	674	4.6%
3	L18-G42-WTP	275,545	5.2%	664	4.5%
4	L30-G30-PT	275,545	5.2%	660	4.5%
5	L30-G30-PL	275,545	5.2%	674	4.6%
6	L30-G30-WTP	275,545	5.2%	660	4.5%
7	L43-G17-PT	275,545	5.2%	660	4.5%
8	L43-G17-PL	275,545	5.2%	674	4.6%
9	L43-G17-WTP	275,545	5.2%	660	4.5%
10	L43-W17-PT	239,250	4.6%	667	4.5%
11	L43-W17-PL	239,280	4.6%	681	4.6%
No Action	L60	181,395	3.5%	415	2.8%

The Proposed Project and action alternatives would contribute to cumulative losses of Water of the U.S. within the HUC. However, it is expected that the majority of these losses will be mitigated through the federal discharge of fill regulatory process (the Corps). The unavoidable adverse impacts to streams and wetlands caused by the development of a reservoir and associated facilities will be mitigated as a condition of the 404 permit. Relative to all the WOUS historically identified in the HUC, the Proposed Project or its action alternatives would contribute a small incremental impact; relative to the previously permitted projects within the HUC, the action alternatives would contribute to additional WOUS impacts as compared to the No Action Alternative. Therefore, cumulative adverse impacts to WOUS are anticipated; however, the implementation of the mitigation would result in a no net loss of WOUS.

Wildlife

Glades Reservoir's footprint would result in the loss and alteration of existing habitat types, creating direct and permanent impacts to terrestrial and aquatic species. Cumulative effects to the overall population of terrestrial wildlife would occur in the county as development and population growth occurs. Over the next 20 years, 48 development projects are anticipated to occur in Hall County. These developments are projected to disturb approximately 12,000 acres of forested areas within the county. Due to the large amount of forested land within Hall County, it is anticipated that both the proposed reservoir and future projects will not result in significant cumulative effects to wildlife known to occupy terrestrial habitats as there are undeveloped areas in the county and adjacent area for displaced

wildlife. The proposed reservoir would result in more habitat for game fish such as spotted bass, crappie, striped bass, and catfish, but would remove the habitat of fish species which prefer streams with swift moving currents such as darters. The proposed reservoir will submerge 94,124 linear feet (0.2 percent) of the total 5,254,549 linear feet swift moving stream habit within Hall County. Due to the total linear feet of stream in Hall County in which aquatic wildlife can occupy, and the requirement for mitigation for impacts to streams that could affect aquatic wildlife, the likelihood of adverse cumulative effects to overall aquatic wildlife populations of Hall County is low. Due to the mobile nature of the wildlife species, their potential to occupy diverse terrestrial habitats and the availability of replacement habitats in and around the reservoir site, cumulative adverse impacts to wildlife are expected to be low.

Protected Species

Cumulative effects to the federally protected northern long-eared bat, Indiana bat, and black-spored quillwort could occur. Given the size of the proposed development projects in Hall County identified in **Table 4.87**, there is a high likelihood that a majority of the commercial/industrial/residential developments and transportation projects would require a Department of Army permits (either individual or nationwide authorizations) for discharges of fill material to WOUS. During the 404 permitting process and in compliance with the Endangered Species Act, the Corps begins the initial informal consultation with the USFWS and based on the type of impacts to protected species avoidance/minimization/mitigation options may be identified. Such regulatory measures will help reduce the synergistic effects of development and may maintain or expand some areas of natural habitat.

Therefore, the potential adverse cumulative impacts to federally protected species would be minimized through the consultation with USFWS. For example, cumulative effects to northern long-eared bat and Indiana bat habitat could occur in the county as the number of forested potential roosting and foraging areas are removed during the construction of the multitude of planned projects in the next 50 years. However, mitigation may occur on a project by project basis such that land clearing activities are restricted to the winter months, thereby avoiding potential impacts to species during the summer months when they may occur in these areas.

Demographic Conditions

Development pressures in the Metro Atlanta area, specifically in Hall County could have synergistic effects on communities in Hall County. As the population ages, Hall County and areas surrounding Lake Lanier, and the bedroom communities of White and Habersham counties could continue to become attractive site to retirees and others. The undeveloped areas in proximity to Lake Lanier could receive development pressures and bring new homes/businesses to the area. Regardless of the Proposed Project's implementation, development would be anticipated in the long term and could have permanent impacts on the roads and housing distribution in the Glades Reservoir vicinity. Changes to area demographics would see both young families as well as empty nesters comprising the future population base of the county.

Housing and Communities

Housing within the past few decades has grown significantly in Hall County. In 1994 approximately 60,700 acres of land within Hall County were used in agricultural practices (Hall County Comprehensive Plan); as the demand for suburban housing increases, the agricultural land decreased to its current size of approximately 23,600 acres (GLUT 2008 Land Use). The county predicts that over the next 50 years, the population will continue to increase. As a result of projected population growth, 26 housing projects, consisting of 14,519 single family homes and 6,768 multifamily homes, may be completed by the year of 2030 (**Table 4.87**). These developments are estimated to require at least 21,300 acres within the county.

The growth of industry, tourism, and Lake Lanier in Hall County, in addition to the suburban development, will continue to increase population in rural residential communities regardless of the development of the Proposed Project. In addition to the existing growth patterns of Hall County, the Proposed Project or its alternatives may contribute to new housing opportunities in and around the reservoir as the lake/reservoir may be perceived as an attractive draw to prospective land owners. Cumulative increases in housing have been demonstrated at the county level with the construction of Lake Lanier and its attraction to residents and businesses. The impacts of the Proposed Project would be at a much smaller scale and as a single-purpose water supply reservoir it would have limited recreational opportunities as compared to Lake Lanier (larger and multi-purpose reservoir). However, the Proposed Project could attract development of new residences and businesses in the vicinity. The construction of the Proposed Project and other planned developments in this area may encourage more development to shift to North Hall County, as opposed to continuing the existing development patterns spilling north from the Metro Atlanta area and around Lake Lanier in South Hall County.

Depending on whether water from the reservoir is to pass through Lake Lanier (PT alternatives) or to be pumped directly to a WTP (PL and WTP alternatives), different water supply watershed protection criteria would apply (namely the buffer requirement for proposed water supply watershed would vary). The PT alternatives would qualify the proposed intake at Lakeside WTP as having a large water supply watershed and would not require additional buffer around the Proposed Project. However, the PL and WTP alternatives would qualify the Proposed Project as a small water supply watershed requiring specified buffer around the perimeter of the reservoir, and buffer and setback for the perennial streams in the watershed. Housing and non-residential developments would need to follow these protection criteria and be located outside of required buffer and setback.

If buffer is required (all PL and WTP alternatives), it is reasonably foreseeable that as development would occur outside of the buffer area and expand the area in which displacements could occur. Given the limited population in the immediate vicinity of the Glades reservoir footprint, there is limited potential for displacements to occur outside the buffer area. However, given the population of White Creek reservoir, there would be greater potential for cumulative impacts to the human environment outside the buffer. As such, the environmental justice populations would not be anticipated to be cumulatively affected by any reasonably foreseeable development that could occur once the Glades Reservoir project is constructed.

If buffer is not required (all PT alternatives), future development could occur closer to the flood pool boundary of the Proposed Project or its alternatives. These reasonably foreseeable future projects may increase the adverse cumulative impacts and result in a higher number of displacements with the construction of the Proposed Project.

Transportation

Hall County has identified 40 roadway improvement projects proposed to be completed by the year 2040 in order to accommodate existing and proposed roadway needs of the county. These roadway improvements have been identified independently of any water supply reservoir. The transportation projects, total approximately $1.5 billion in infrastructure investments over the next 25 years, consist of

- 9 bridge replacements,
- 1 new interchange on I-985,
- 1 intersection improvement at Jesse Jewel Pkwy and John Morrow Parkway,
- 3 new location roadways,
- 25 roadway widening projects, and
- 1 trail project.

As the numbers indicate with road widening projects, 92 percent of proposed roadway construction would occur along the existing transportation network; thereby, serving existing development patterns. Construction of new roads associated with the Glades Reservoir may open the possibilities for development; however, that development is expected to be localized. The county-proposed transportation plan primarily anticipates expanding the existing roadways.

The contribution of 3 re-routed roads to accommodate travel around the Glades Reservoir would be considered minor in comparison to the 40 transportation projects identified in the county. Therefore, transportation infrastructure as a result of the Proposed Project would contribute a small incremental but cumulative increase to the overall county system.

Parks/Recreation Areas

There is an extensive existing system of Gainesville and Hall County parks, recreation and community centers, and conservation areas. Multiple documents outlined the plan for these community resources, including the GHCCP and Greenspace Initiative - Vision 2030 (http://www.vision2030.org/). Gainesville and Hall County have numerous park and recreation facilities containing both active and passive recreation opportunities. There are also plans to increase greenspace and trails throughout the county. The city and county are undertaking comprehensive parks plans and plan to acquire open space in accord with those plans, which will include natural resource areas. Increasing park and recreation areas can help mitigate some of the land use changes due to anticipated development in the county.

According to the Transportation Plan, the county has conducted a parks impact fee background study and is considering adopting park/open space impact fees. The Propose Project or its alternatives would contribute cumulatively to the parks and recreation areas available in Hall County. Although the primary purpose of the proposed reservoir is water supply, passive recreational activities such as fishing and

non-motorized recreation activities, trails, and picnicking will be allowed (most likely for a designated time during the week and the weekends) and these activities are consistent with the local vision of acquiring open space and natural resources. The limited recreational activities created by the proposed reservoir would enhance Hall County's future plans to expand the park system and constitute a long-term beneficial cumulative impact to Hall County.

Economics

Hall County's economy is growing steadily and continued growth is predicted as time passes. Gainesville-Hall County reported the rebound of the housing market with the number of new housing permits (a key housing indicator) issued in 2014 reaching an all-time record since the Great Recession in 2008. According to Greater Hall Chamber of Commerce, 24 economic development projects were announced in 2014 creating 1,300 new jobs and $150 million in investment over an 18-month period in 2015-2016. Companies to contribute to economic development projects included Kubota, King's Hawaiian, Jinsung TEC, Georgia Chair, Big Creek Foods, Innobots and many others. **Table 4.87** summarizes the 31 planned non-residential parks (commercial, institutional, and industrial parks) to be operational by the year 2030. These businesses will occupy approximately 19,400 acres within Hall County and provide jobs for local Hall County residents as well as neighboring counties. In addition, Gainesville-Hall County is a growing regional center of Healthcare Services for over 500,000 people in a 16-county area of Northeast Georgia. Hall County's growing healthcare sector employs 11,520 or approximately 14.6% of the current workforce in Hall County; employment in this sector is expected to grow in the next 50 years as population increases.

The Proposed Project is expected to provide the county a reliable future water supply source and would contribute to secure and promote Hall County's growing economy. The Proposed Project or its alternatives is anticipated to be an important element in maintaining the quality of life for Hall County residents and workers.

The county is planning on a number of development and transportation projects over the foreseeable future, therefore numerous construction workers would be in demand regardless of the Proposed Project. The Proposed Project and alternatives' direct contribution to the local economy would translate into temporary jobs from construction activities and permanent jobs from the operation and maintenance (O&M) of the facilities. The major long-term economic benefit of the Proposed Project is to provide a secure water supply source that will support the future development plans of the county. From a labor force perspective, because full-time employment positions for the operation of the Proposed Project are limited, there is no potential labor pressure resulting from this project that would reduce the labor pool for other county jobs and growth. In addition, due to the multi-year phasing of the construction, it is less likely that labor would be diverted from other projects in Hall County or brought in from elsewhere within the Metro Atlanta region.

An important aspect to consider in the cumulative effects of the local economy is that the Proposed Project construction would be financed in large part with user fees. As indicated previously (**Section 4.9.4.2**), the City of Gainesville would not contribute to payment to support the reservoir project. As

such, the county's continued development would help to pay for the proposed reservoir. According to the Transportation Plan, both Gainesville and Hall County are committed to examining a range of tools to deal with the cost of growth, including impact fees (which the county already has) and fiscal impact assessment requirements for new development. Therefore, it is reasonably foreseeable that regardless of the construction of the Proposed Project, user fees would be implemented for other county infrastructure. Regardless of the Proposed Project, existing and future development would require the long-term water infrastructure improvements for residents and businesses in Hall County.

The Proposed Project combined with future land-based actions would contribute to cumulative changes on the socioeconomics of the area by increasing the population and labor force. However, depending on the types of development associated with the reservoir, these changes may or may not be considered adverse. The major cumulative benefit of providing a water source for the county would be to support the long-term viability of the county and to allow for economic growth by securing a local water supply source the county would own and operate, as opposed to Lake Lanier being controlled by the Corps and the lengthy tri-state controversy affecting the availability of water supply allocation to Hall County.

4.15.3.7 Visual and Aesthetic Resources

Of the land-based projects listed in **Table 4.87** and **Table 4.88**, the proposed future residential, commercial and industrial developments and transportation projects would have the greatest cumulative impacts on visual resources in the county. These reasonably foreseeable projects would continue to increase development density in Gainesville and South Hall County and would transform North Hall County from a more rural, low density residential setting to a suburban environment with town/community developments in Lula, Clermont, Gillsville (in addition to towns and communities in South Hall County).

The Proposed Project would add incrementally to this impact. The Proposed Project would convert rolling wooded terrains and open field vista to an open water (dam/reservoir) setting. Temporary visual impacts would result from construction of the water supply infrastructure components including clearing and grading. Depending on how water from the reservoir would be transmitted to the WTP, the Georgia water supply rules that dictate buffer and watershed protection requirements vary (small water supply watershed vs large water supply watershed) for the proposed reservoir and may affect the visual setting surrounding the reservoir. In addition, the river pump station, booster pump station, and WTP (if the PL or WTP alternative is selected), would have a long-term impact to the visual setting. The transmission mains would be underground; the booster pump station would be in an existing urban environment and would add very minor incremental impacts to all the planned projects in Hall County. The visual impacts of the White Creek Reservoir would be located in White County instead of in Hall County. These impacts would be part of cumulative impacts to the greater impacts resulting from the multitude of future development and transportation projects in Hall County.

Hall County has multiple existing significant viewsheds including community entrance/gateways, lake crossings or approaches, primary corridors, and other views. The scenic topography of North Hall County and Lake Lanier are the most significant natural visual resources. Many of these viewsheds are seen

from highways and roadways or are gateways to the county or City of Gainesville. The construction of the reservoir in Hall County would add beneficial cumulative visual impacts to the county as the county would lose many of its undeveloped lands to future development projects. Although there would be loss of rolling wooded terrains and open field vista, the county would gain in open water/dam/lake vista and the viewsheds from the dam access road and lake crossing would be considered beneficial.

4.15.3.8 Air Quality

The Glades Reservoir project would be constructed within a period of time where multiple planned projects/developments are going to be under construction in Hall County. Construction of most of the reasonably foreseeable future projects (see **Table 4.87** and **Table 4.88**) would involve the use of heavy equipment that would generate emissions of air contaminants and fugitive dust. Therefore, it will be one of many construction projects that could contribute to short-term adverse impacts to air quality. The fugitive dust emissions and criteria pollutants would be controlled by mitigation such as phased construction, carpooling, reasonable precautions to prevent dust through covering stockpiles, use of water to control dust, etc. Hall County can potentially consider phasing of the residential construction permits issued in any given year that would dissipate air quality impacts. In addition, according to the 2040 Transportation Plan, the county plans to provide alternative transportation practices (such as transit project and bike paths) to improve circulation systems and to reduce air quality impacts. Additional traffic control measures considered include strategies to decrease reliance on single occupancy vehicles (SOV), reduce congestion, and reduce air emissions. These practices in addition to project-specific control technologies would cumulatively benefit air quality within the county. The identification of these practices demonstrates Hall County's commitment to air quality, and indicates support for the consideration of alternatives to minimize emissions.

4.15.3.9 Noise

Short-term increases in ambient noise levels associated with construction activities are anticipated for all components of the proposed land-based project. These impacts would be localized and heard by the few residents within approximately 800 feet from the area of direct impact. Noise impacts during construction and operation of any of the foreseeable projects listed in **Table 4.87** and **Table 4.88** would be highly localized and attenuate quickly as the distance from the noise source increases. In addition, no reasonably foreseeable projects have been identified within 800 feet of the Glades Reservoir alternatives; therefore, no cumulative impacts due to construction projects located in close proximity are likely to occur.

While most existing sources of noise within the reservoir footprint such as agricultural activities, automobile traffic, and lawn maintenance equipment would end, there is likely to be long-term noise associated with local roads relocated near residents and new road traffic in the vicinity of the reservoir, pump stations, and WTP (if this alternative is selected at Glades Reservoir). Increases in noise would not create areas of incompatible land use or violate any federal, state, or local noise ordinance. These roads currently have low traffic volumes. If future development associated with the reservoir were to occur, cumulative impact of the additional vehicles on the roads would likely result in an increase in noise. This would be considered a minor long-term adverse cumulative impact.

Relative to the potential of other construction projects proposed in Hall County, the river pump station's long-term noise impact would be negligible. Despite of the proposed mitigation to house the booster pump station in a building, it may contribute incrementally to the noise pollution in the more urbanized environment. This would be considered a minor long-term adverse cumulative impact.

4.15.3.10 Cultural Resources

The reasonably foreseeable future developments, especially residential development, will increase surface disturbance in Hall County. Only development projects that require environmental permitting, such as Section 404 permit, are required to include cultural resources impact assessments in the planning process. Historically, private residential and commercial developments or city or county roads have not been required to conduct cultural resources impact assessment.

One of the benefits of the Proposed Project is the identification of new historic and archaeological resources that provides enhanced understanding of what the area was like during the 19th and 20th centuries. Greater adverse cumulative impacts would result from future residential commercial development because little effort would be made to mitigate these impacts.

The GHCCP and the 2040 Transportation Plan discussed the county's long-term plan to conserve and protect the natural environment, open spaces, and historic resources. This preservation of historic resources is recognized as an important contributor to community livability and economic development. The city and county are considering the undertaking of a local preservation plan and to adopt local historic preservation regulations to provide a greater measure of protection for cultural resources and landmarks. The use of federal and state tax incentives for historic preservation projects is also being evaluated.

Adverse cumulative impacts to the Glade Farm House and the Mose Gordon Lumber Company Mess Hall would occur. Specifically, these resources would experience a compromised setting, which is considered an adverse effect under Section 106. There is potential for additional development along the perimeter or in the vicinity of the reservoir. If this occurs, the settings of these National Register-eligible properties could be affected cumulatively by introducing modern elements to the setting. While this is a possibility, the measures outlined by the county for the preservation of historic resources would seek to minimize the potential impacts.

In terms of cumulative impacts to cultural resources within the county, the community has maintained data bases, inventoried these resources, and documented goals associated with the preservation of the cultural resources. Based on the stated cultural resource goals, protections for these resources are anticipated to continue. These planning elements demonstrate the county's resolve to reduce the potential that additional cumulative adverse long-term impacts would occur to cultural resources within the county.